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53-1-2/8

The Investigations Dealing With the Physics of Particles With High Energy at the Synchrocyclotron of the Laboratory for Nuclear Problems of the United Institute for Nuclear Research

560 MeV; the determination of the mass of the mesons, which form by the action of 500 MeV-particles; the fission of nuclei under the impact of pions; the spalation of α--particles with the energy of 560 MeV into single nucleons; the stripping of deuterons; the detection of the hard γ--radiation, which originates from the target of the synchrocyclotron; the fission of nuclei in case of the action of neutrons; the artificial α-radioactivity; the elastic scattering of protons by nucleons; the elastic scattering of protons by protons and the polarization in case of the elastic (p-p)-scattering; the elastic scattering of neutrons by neutrons and protons; the energy [illegible] scattering of neutrons by deuterons at the energy [illegible] scattering of protons by deuterons [illegible]

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53-1-2/8

The Investigations Dealing With the Physics of Particles With High Energy at the Synchrocyclotron of the Laboratory for Nuclear Problems of the United Institute for Nuclear Research

processes of meson-production and the angular distributions of the mesons; the energy spectra of the particles, which are emitted in case of inelastic collisions of two nucleons; the production of pions by mesons; myons; strange particles; the interaction of energy-rich particles with composed nuclei; the methods of investigation and the apparatus used; The examination discussed here enlarged the knowledge on this field and raised some new important problems; they also showed effective ways for the solution of these problems. The investigations also were a good training for the education of a numerous collective group of Soviet physicists, engineers, and designers of various branches. One of the purposes of the institute mentioned in the title, is the training of staff groups of physicists from the 12 countries, which are partners in the institute. There are at present, in total, 161 collaborators, all of which are

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PONTEKORVO, B. M.

"Pion Nucleon Scattering, etc."

report presented at the Intl. Conference on High Energy Nuclear Physics, Kiev, 15-25 July 1959.

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"APPROVED FOR RELEASE: 07/13/2001 CIA-RDP86-00513R001342210003-5

24(5), 3(1)

AUTHOR: Pontekorvo, B. SOV/56-36-5-76/76

TITLE: The Universal Fermi Interaction and Astrophysics (Universal'noye vzaimodeystviye Fermi i astrofizika)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 36, Nr 5, pp 1615-1616 (USSR)

ABSTRACT: By way of introduction the possibility of an analogy between the lepton decay mechanism of elementary particles and the non-lepton decay mechanism is discussed, and a number of papers dealing with this problem is mentioned. In the present "Letter to the Editor" the author shows that it follows from $\beta$-interaction that positron-electron annihilation may occur with emission of a neutrino-antineutrino pair, and that in electromagnetic processes a $\nu\bar{\nu}$-pair emission may occur instead of a photon emission. This fundamental connection between electromagnetic phenomena and lepton processes follows immediately from universal Fermi interaction. In the following, the author investigates the probability of the occurrence of a lepton process for the case of a neutron-electron interaction in heavy bodies at very high

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[illegible] in plasma which are in a state of development. It is necessary that the temperature and the average charge of by far surpass the solar values. On the sun (kT ~ 1 kev, Z ~ 1) it is practically of no consequence. As shown by G. M. Gandel'man and V. D. Pinayev, the astrophysical conditions for the occurrence of a lepton bremsstrahlung in the temperature range of $kT > 30$ kev at pressures $> 10^4 g \cdot cm^{-3}$ and $Z \approx 20$ would appear to exist. The author thanks

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The Universal Fermi Interaction and Astrophysics SOV/56-36-5-76/76

Ya. B. Zel'dovich, D. A. Frank-Kamenetskiy and L. B. Okun' for critical remarks and their interest in this investigation, and he also thanks G. M. Gandel'man and V. S. Pinayev for information concerning the results of their investigations. There are 6 references, 1 of which is Soviet.

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy (Joint Institute of Nuclear Research)

SUBMITTED: March 23, 1959

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21 (1)

SOV/56-36-6-59/66

AUTHORS: Zinov, V. G., Konin, A. D., Korenchenko, S. M., Pontekorvo, B.M.

TITLE: A Possible Method of Searching for $\rho^0$-Mesons (Vozmozhnyy metod poiska $\rho^0$-mezonov)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 36, No 6, pp 1940 - 1940 (USSR)

ABSTRACT: [illegible] draw the attention of the authors of the present letter to the [illegible] in the energy dependence of meson reactions. As this proved to be a possibility of detecting $\rho^0$ mesons, the authors systematically investigated these cases and give a report on the results obtained. The intensity of a relatively narrow singularity in the energy dependence of the $\pi$ p-interaction cross section might, in principle, indicate the existence of a $\rho^0$-meson. It might be expected that in the reactions $\pi^- + p \rightarrow \pi^- + p$ and $\pi^- + p \rightarrow \pi^0 + n$ an anomaly occurs in the energy dependence on the threshold of the reaction $\pi^- + p \rightarrow \rho^0 + n$. The

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A Possible Method of Searching for $\rho^0$-Mesons SOV/56-36-6-59/66

width of the singularity depends on the interaction radius and may be obtained from the condition $kR \ll 1$; here k denotes the wave vector of the $\rho^0$-mesons formed in the c.m.s. This possibility is briefly discussed. It is assumed that the life of the $\rho^0$-mesons is long as against $\hbar/m\,c^2$. The relative amplitude of the singularity $\Delta\sigma/\sigma$ may amount to some %. The $\rho^0$-meson is assumed to differ from the $\pi^0$-meson only by the isotopic spin (T = 0). The $\rho^0$-meson cannot decay quickly into 2 pions because of the conservation of parity, and because of the conservation of the quantum number C also not into 3 pions, so that the decay $\rho^0 \to \gamma + \gamma$, or, if the mass is sufficiently large, $\rho^0 \to \pi + \pi + \gamma$. If $m_{\rho^0} > 560$ Mev/$c^2$, it may also decay into four pions. Finally, several further problems connected with the mass of the $\rho^0$-meson are discussed. Ya. B. Zel'dovich pointed out that the existence of an exchange scattering of antiprotons ($\bar{p} + p \to \bar{n} + n$) indicates a difference between the

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A Possible Method of Searching for $\rho^0$-Mesons SOV/56-36-6-59/66

masses of $\pi^0$- and $\rho^0$-mesons. The authors finally thank L. I. Baz', V. B. Belyayev, B. N. Zakhar'yev, L. B. Okun' and Ya. A. Smorodinskiy for discussions. There are 6 references, 3 of which are Soviet.

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy (Joint Institute of Nuclear Research)

SUBMITTED: March 23, 1959

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[illegible] the problem concerning the existence of two neutral lepton pairs (electron pair, $\nu_e$ and $\bar{\nu}_e$, and muon pair, $\nu_\mu$ and $\bar{\nu}_\mu$). To solve the fundamental question of whether $\nu_\mu$ and $\nu_e$ are identical particles, a method was proposed analogous in essence to the method used to solve the problem of distinguishing between the neutrino and antineutrino or $K^0$- and $\bar{K}^0$ -mesons. In principle, the problem can be

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solved if it is demonstrated experimentally that a $\bar{\nu}_\mu$ beam is capable of inducing transitions, as $\bar{\nu}_e$ particles certainly can induce (e.g., the $\bar{\nu}_\mu + p \longrightarrow e^+ + n$ reaction). The experiment suggested above, although difficult, should be feasible with accelerators capable of producing beams more intense than those obtained with present-day accelerators. Chzhou Guan-chzhao, L. B. Okun, Ya. A. Smorodinskiy, and E. M. Lipmanov participated in the discussion of this subject. There are 1 table; and 17 references, 5 Soviet, 1 U.K., 11 U.S. The 5 most recent U.S. references are: F. Reines, C. L. Cowan, Phys. Rev., 90, 492, 1953; 113, 273, 1959; S. Oneda, J. C. Pati, Phys. Rev. Lett., 2, 125, 1959; G. Feinberg, Phys. Rev., 110, 1482, 1958; R. P. Feynman, M. Gell-Mann, Proc. of the VIIth Conf. on High Energy Physics, Geneva, 1957; D. Perley, J. Lee, M. Pardon, Phys. Rev.,

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Electron and Muon Neutrons

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SOV/56-37-6-31/55

R. T. Siegel, A. E. Taylor, Phys. Rev. Lett., 2, 107, 1959.

ASSOCIATION: Joint Inst. Nuclear Research, USSR (Ob'edinennyy institut yadernykh issledovaniy, SSSR)

SUBMITTED: July 9, 1959

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24.6100

AUTHOR: Pontekorvo, B.

TITLE: New Strange Particles

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 38, No. 5, pp. 1654 - 1656

TEXT: The present "Letter to the Editor" is a contribution to the systematics of elementary particles. In the introduction, the author briefly refers to Gell-Mann's system which takes account of the possible existence of further unknown baryons and mesons as, e.g., the $Z^+$ and $D^+$ particles. There is a number of reasons suggesting that the former does not exist. As regards D-particles, it is noted that Van Gan-chan gave a report on bubble-chamber pion-interaction experiments at the Conference of Physics of High-energy Particles (Kiyev), in which an event was observed that can be interpreted with the help of D-particles. The mass of the D-meson may be ~750 Mev, its decay mode: $D^+ \to K + \pi \begin{cases} K^0 + \pi^+ \\ K^+ + \pi^0 \end{cases}$. According to

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New Strange Particles

the Gell-Mann system, a strangeness of +2 is ascribed to the positive D-meson. Its lifetime might be of the order of $10^{-10}$ sec. The isotopic spin of the system ($K\pi$) must be 1/2 or 3/2, so that the selection rule $\Delta T = 1/2$ does not influence the decay, as is the case with the $K^+$ meson. The author suggests to attempt the detection of D-mesons with the help of the emission of K-mesons on D-meson decay. A target is bombarded with high-energy particles, and the K-mesons produced in the vacuum due to the D-decay are recorded after their passage through a collimator. Garvin employed a similar method to record strange particles (recording of the gamma quanta from $\pi^0$ decay, emitted by strange particles). On account of the small D-meson production probability, the intensity ratio of K- and $\pi$-mesons from the target and from the "vacuum" near the target must be $(K/\pi)_{vac} \ll (K/\pi)_{targ}$. Some numerical estimates for this are discussed. Then, the author studies the $K^0$ emission from D-particles, and discusses some problems connected with the recording and the necessary target shielding. On bombardment on the proton synchrotron with intensities of the order of $10^{10} - 10^{11}$ protons/pulse it is possible to record the $K_2^0$

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New Strange Particles

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meson with a large Wilson cloud chamber, a bubble chamber, or an emulsion chamber. The ratio from the target and the vacuum must be measured in any method. The analogous ratios must also be measured when $K^+$ recording (from the $D^+ \rightarrow K^+ + \pi^0$ decay) is carried out in photoemulsion chambers or by means of electronic methods. Finally, the author discusses some problems connected with the emission angles of the various particles. V. I. Veksler, Chzhou Guan-chzho, M. Ya. Danysh, and M. I. Podgoretskiy are thanked for discussions. There are 5 references: 2 Soviet and 2 Italian.

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy (Joint Institute of Nuclear Research)

SUBMITTED: March 31, 1960

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24.6900 (1138, 1191, 1559)

AUTHORS: Zinov, V. G., Konin, A. D., Korenchenko, S. M., Pontekorvo, B.

TITLE: The Search for the $\rho^0$ Meson and the Verification of Dispersion Relations in πN Scattering

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 38, No. 6, pp. 1708 - 1714

TEXT: Results of $\pi^-p$ interaction cross section ($\sigma_t^-$) measurements and of the energy dependence of $\sigma_t^-$, as well as a comparison of the results with those obtained by other authors are given. The object of the study was to look for anomalies in the energy distribution of $\sigma_t^-$ ($\rho^0$ meson) and to check the Puppi-Stanghellini problem. The experimental arrangement is first described (Fig. 1). The target was liquid hydrogen in a vessel made of foam polystyrene (walls, 0.8 g/cm$^2$). The hydrogen density was 0.0708 g/cm$^3$ so that $(0.4607 \pm 0.0023) \cdot 10^{24}$

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The Search for the $\rho^0$ Meson and the Verification of Dispersion Relations in $\pi N$ Scattering

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hydrogen nuclei fell in the path of the beam trajectory per $cm^2$. The electronic apparatus was the same as described in Ref. 3; the photomultipliers used together with the scintillation counters were of the [illegible] spread of the beam was 10.5 Mev/cm. The energy loss in hydrogen was ~3 Mev. $\sigma_t$ was measured for about 50 pion energy values in the range 140-360 Mev with a total accuracy of 1.5 - 2%, but no anomalies could be found which would indicate the existence of a $\rho^0$ meson. The individual values of measurement are shown in a table; the data for accuracy refer to systematic errors. The results of the study are discussed in detail. The fact that no anomalies exceeding 3 - 4% could be found in the energy dependence of the cross section values for the energy range 140 - 360 Mev, and so no $\rho^0$ meson having a mass of between 270 and 410 Mev/$c^2$ could be found, does not mean that no such mesons exist. The data obtained are in conflict with the peaks



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The Search for the $\rho^0$ Meson and the Verification of Dispersion Relations in $\pi N$ Scattering

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for $\sigma_t^-(E)$ ($E_2 \sim 650$ Mev and $E_3 \sim 950$ Mev) obtained by Frisch et al., but agree with the values ($E_2 \approx 610$, $E_3 \sim 880$ Mev) obtained by Brisson. The data are also in agreement with the dispersion relations for $\pi^- p$ scattering. So it can be proved that the Puppi-Stanghellini problem as such does not exist; it arises only from the inaccuracy in the measurement of the total $\pi^- p$ interaction cross section. [illegible] are thanked for discussion, and Yu. M. Ostanevich for help in the computations. The results were already communicated to the Conference on Physics of High-energy Particles held in Kiyev in 1959. There are 4 figures, 2 tables, and 15 references: 4 Soviet, 1 British, 3 Italian, and 7 US.

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy (Joint Institute of Nuclear Research)

SUBMITTED: January 13, 1960

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KOBZAREV, I.Yu.; PONTEKORVO, B.

Parity nonconservation and macroscopic rotation. Usp. fiz. nauk 81 no.1:3-6 S '63. (MIRA 16:12)

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PONTECORVO, B

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B006/B070

AUTHORS: Bakish, M. Ya., Egiazaryan, L. M., Landsberg, L. G., Lebedev, P. I., Obukhov, Yu. P., Pontecorvo, B.

TITLE: Non-radiative Transitions in Heavy $\mu$-mesic Atoms

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 39, No. 6, pp. 1715 - 1719

TEXT: This paper is concerned with studies of the spectra of X-ray lines emitted by mesic atoms of uranium and lead. Since so far only two 2P→1S transition mechanisms in mesic atoms have been studied (emission of meso-X-ray photons, and Auger effect), this work is a supplement as well as a contribution to the data on the properties of heavy nuclei. The experimental arrangement is described in the introduction and schematically shown in Fig. 1. A beam (270 Mev/c) from the synchrocyclotron of OIYaI (Joint Institute of Nuclear Research) was used. The targets had a thickness of 10.7 g/cm² for uranium and of 10.5 g/cm² for lead. A scintillation counter with a photomultiplier

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of the type FEU-33 (FEU-33) served as the gamma quantum detector. The counter pulses were conveyed to a 64-channel pulse-height analyzer. The background of the accidental coincidences amounted to about 5% of the counting rate. A $Na^{24}$ source ($E_\gamma$ = 1.38 and 2.75 Mev) was used for calibration and checking the linearity. The results of measurement for the range 3 - 8 Mev are shown in Fig. 3. Curve I gives the upper limit of the background, II the lower limit for the background of Pb, and III the lower limit for the background of U (n - number of counts per analyzer channel). The spectra are normalized for one and the same $\mu$-meson stopped in the target. The Th curve has a clear peak at ~5.3 Mev. On account of the smallness of the NaI (Tl) crystal this peak can be due to three photon energies: 1) $E_\gamma$ = 5.31 Mev; 2) $E_\gamma$ = 5.51 Mev; 3) $E_\gamma$ = 6.02 Mev, where $E_\gamma$ = 6.02 Mev is the energy of the 2P→1S transition photons in mesic lead. In the region of the peak (5 - 5.5 Mev), less counts were obtained from uranium than from lead. The mean number of the peak corresponding to the transition 2P→1S is about 200 less/per from uranium than from lead. The photon intensity difference at 6 Mev in mesic uranium and mesic lead indicates that a non-radiative

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transition of $\mu^-$ mesons to the 1S level of mesic uranium takes place here. Such a non-radiative transition in which the transition energy is directly transferred to the nucleus, had not yet been observed. A rough estimate of the ratio of the non-radiative transition probability to that of emission of a photon gives the value $(\Gamma_{non\text{-}rad}/\Gamma_{rad})_{238} \approx 0.2$. Preliminary experiments have further shown that non-radiative transitions take place also in $Th^{232}$.

A. E. Alikhanov is thanked for his interest, and B. F. Zarubitskiy for making some results available before publication. G. Ye. Solov'yeva is mentioned. The preliminary results of these investigations were communicated by L. I. Alikhanov to the Eighth All-Union Conference on Physics of High-energy Particles held in Kiyev in 1959. There are 3 figures and 6 references: 2 Soviet, 3 US, and 1 Dutch.

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SUBMITTED: January 19, 1960

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24.6900
AUTHOR: Pontekorvo, B.

TITLE: The Performance of Experiments by Means of Neutrino Beams of Mesic Origin

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 39, No. 4(10), pp. 1166 - 1168

TEXT: For the purpose of obtaining data on weak interaction, the possibility of using high-energy neutrinos emitted by mesons has recently been discussed. The discussions especially concerned experiments with high-energy neutrino beams ($\gtrsim$1 Bev), which are intended to determine the existence of the intermediate meson (B) in weak interaction. R. M. Ryndin and the writer of the present "Letter to the Editor", as also Lee and Yang pointed out that such an intermediate boson with a mass of the order of the nucleon mass might be found in reactions of the mode $\nu + Z \to B + Z + \begin{cases} \mu \\ e \end{cases}$. Already in an earlier paper (Ref. 1), the author suggested proving the identity of the neutrino $\nu_\mu$ (emitted in $\pi$-$\mu$ decay), and of the neutrino $\nu_e$

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The Performance of Experiments by Means of Neutrino Beams of Mesic Origin.

(emitted in $\beta$-decay). Now, additional facts concerning neutrinos with $E_\nu < 300$ Mev are discussed here. This discussion is of interest for the planning of experiments with neutrino beams. Besides the problem of the $\beta$-meson and that of the energy dependence of weak interaction processes, the following questions are of importance in neutrino physics: 1) whether $\nu_e$ and $\nu_\mu$ are identical, and 2) whether a neutrino scattering by electrons in first order of the weak interaction constant exists. In order to be able to answer these questions, a neutrino beam with $E_\nu < 300$ Mev is

[illegible] may be used.

[illegible] of the reaction $\nu_\mu + O^{12} \rightarrow e^- + N^{12}$ may be measured. There are [illegible]

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PONTEKORVO, B.

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B006/B056

AUTHORS: Belyaev, S. T., Kondrat'yev, L. N., Landsberg, L. G., Lobashov, V. M., Osetinov, E. V., Pontekorvo, B.

TITLE: The Intensity of Radiationless Transitions in Muonic Atoms

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 39, No. 4(10), pp. 1160 - 1170

TEXT: In an earlier paper (Ref. 1) the authors found that the intensity of muonic X-rays $2P \rightarrow 1S$ in $U^{238}$, normalized to one stopped muon is considerably less than in Pb. This fact indicates the existence of radiationless transitions in heavy muonic atoms, in which the energy of the $2P \rightarrow 1S$ transition is not liberated in the form of an X-ray photon. It is assumed that the probability of radiationless transition ($W_{nl}$) in muonic lead is negligibly small in comparison to the probability ($W_{k\mu}$) of a transition with emission of one photon ($W_{k\mu})_{Pb} \cdot (1 + (W_{nl})_{Pb} U^{238}/(W_{k\mu})_{Pb} U^{238}) > 0.1$. Now, the authors investigated the $2P \rightarrow 1S$ transition intensities in the

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muonic atoms of Pb, Bi, Th, $U^{235}$, and $U^{238}$, and give a report on this investigation. With the help of a scintillation spectrometer, the X-ray spectra in the energy ranges corresponding to the transitions were measured. Special attention was paid to determining the background level. Fig. 1 and 2 show examples of the spectra recorded. Fig. 1 shows the spectra of muonic X-ray photons from targets of Pb(4.46 $g/cm^2$), Bi(4.46 $g/cm^2$), and $U^{238}$(4.60 $g/cm^2$); as abscissa, the pulse height in volts, and as ordinate, the number of pulses in an interval of 5v is taken. Fig. 2 shows the same for Pb(5.56 $g/cm^2$) and $U^{235}$(5.59 $g/cm^2$). The intensities of muonic X-radiation ($2P \rightarrow 1S$) normalized to one stopped $\mu^-$-meson (in relative units) are given in a table:

| | Intensities | Fraction of radiationless $2P \rightarrow 1S$ transitions |
|---|---|---|
| Pb | 1 | 0 |
| Bi | $0.85 \pm 0.06$ | $0.15 \pm 0.07$ |
| Th | $0.71 \pm 0.05$ | $0.29 \pm 0.05$ |
| $U^{235}$ | $0.77 \pm 0.04$ | $0.23 \pm 0.04$ |
| $U^{238}$ | | |

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There are 2 figures, 1 table, and 1 Soviet reference.

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy (Joint Institute of Nuclear Research). Institut teoreticheskoy i eksperimental'noy fiziki AN SSSR (Institute of Theoretical and Experimental Physics AS USSR)

SUBMITTED: August 13, 1960

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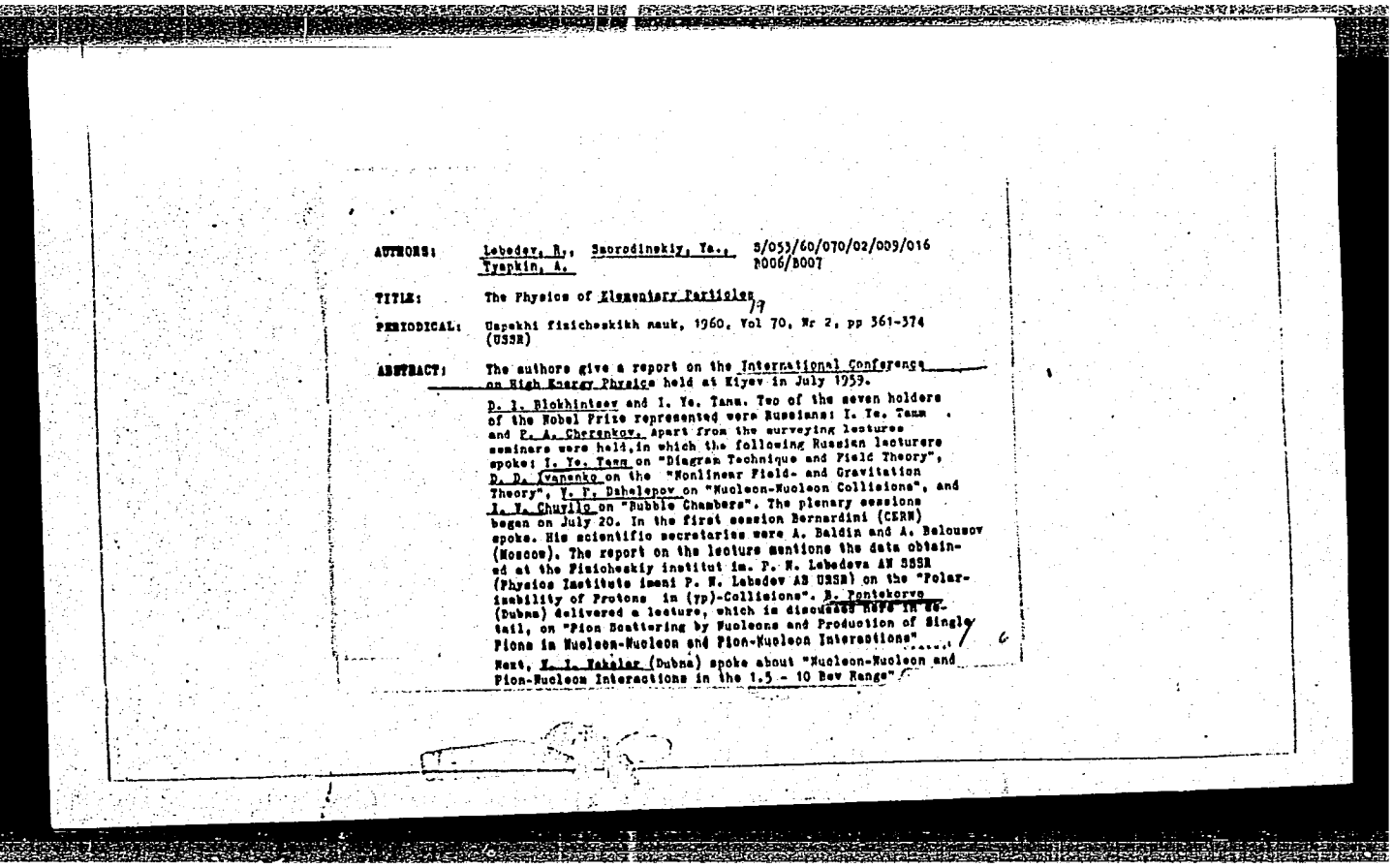

AUTHORS: Lebedev, P. I., Smorodinskiy, Ya., Tyapkin, A. S/053/60/070/02/009/016 B006/B007

TITLE: The Physics of Elementary Particles

PERIODICAL: Uspekhi fizicheskikh nauk, 1960, Vol 70, Nr 2, pp 361-374 (USSR)

ABSTRACT: The authors give a report on the International Conference on High Energy Physics held at Kiyev in July 1959.

D. I. Blokhintsev and I. Ye. Tamm. Two of the seven holders of the Nobel Prize represented were Russians: I. Ye. Tamm and P. A. Cherenkov. Apart from the surveying lectures seminars were held, in which the following Russian lecturers spoke: I. Ye. Tamm on "Diagram Technique and Field Theory", D. D. Ivanenko on the "Nonlinear Field- and Gravitation Theory", V. F. Dshelepov on "Nucleon-Nucleon Collisions", and I. V. Chuvilo on "Bubble Chambers". The plenary sessions began on July 20. In the first session Bernardini (CERN) spoke. His scientific secretaries were A. Baldin and A. Belousov (Moscow). The report on the lecture mentions the data obtained at the Fizicheskiy institut im. P. N. Lebedeva AN SSSR (Physics Institute imeni P. N. Lebedev AS USSR) on the "Polarizability of Protons in (γp)-Collisions". B. Pontekorvo (Dubna) delivered a lecture, which is discussed here in detail, on "Pion Scattering by Nucleons and Production of Single Pions in Nucleon-Nucleon and Pion-Nucleon Interactions". Next, V. I. Veksler (Dubna) spoke about "Nucleon-Nucleon and Pion-Nucleon Interactions in the 1.5 - 10 Bev Range".

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PONTECORVO, Bruno M. and SMORODINSKIY, Ya. A.

"Neutrino Component of Cosmic Rays and Cosmological Considerations."

report presented (by L. D. Puzikov) at the IUPAP sponsored Intl. Conf. on Theoretical Aspects of Very High Energy Phenomena, CERN Headquarters, Geneva, 5-9 June 1961.

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OKUN', L.B.; PONTECORVO, B.

Is 'muonium one' heavier than 'muonium two' or viceversa?
Dubna, Izdatel'skii otdel Ob"edinennogo instituta iadernykh
issledovaniy, 1961. 5 p.
(No subject heading)

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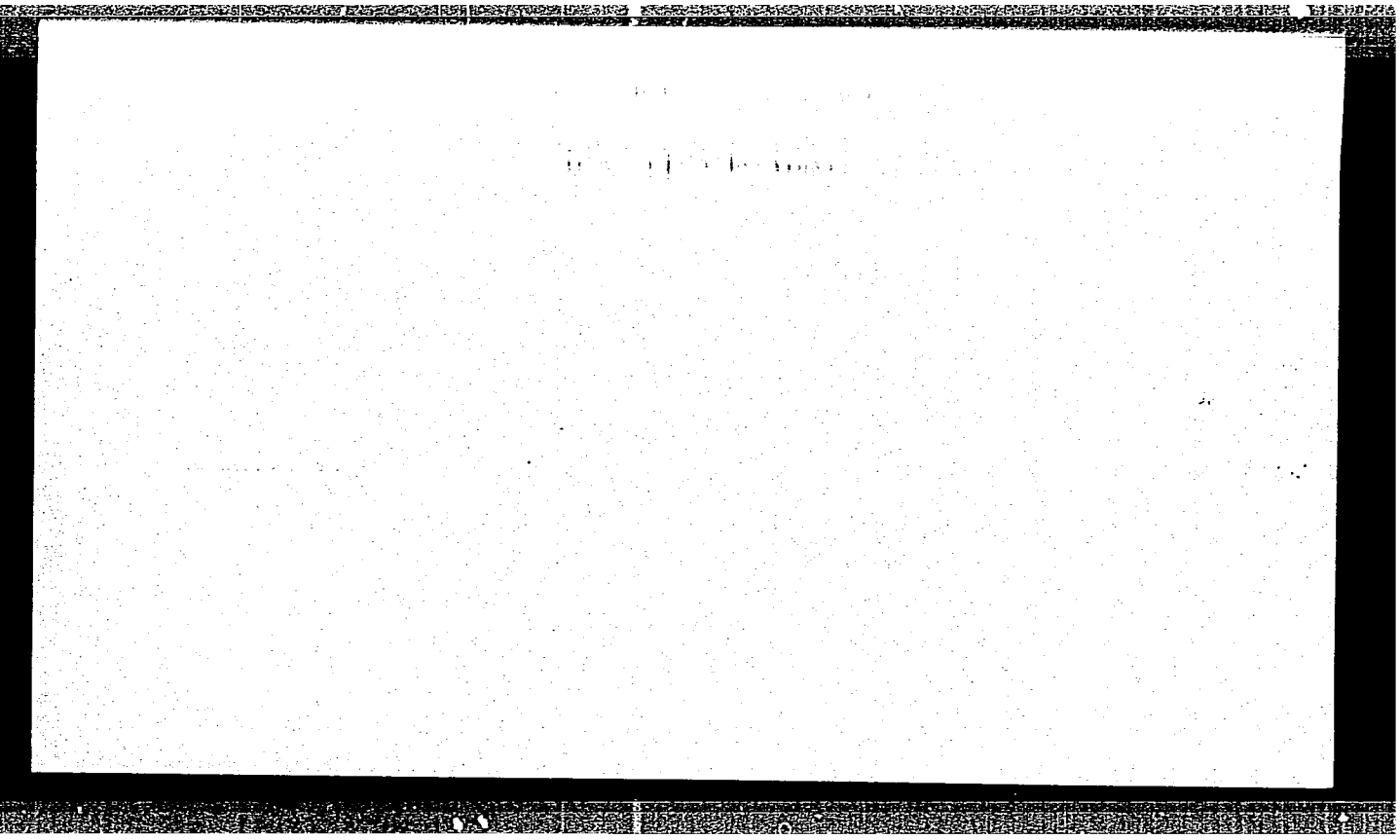

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PONTECORVO, B. M.

PHASE I BOOK EXPLOITATION SOV/5982

International Conference on High-Energy Physics. 9th, Kiyev, 1959.

Devyataya mezhdunarodnaya konferentsiya po fizike vysokikh energiy, Kiyev 15-25 iyulya 1959 g. (Ninth International Conference on High-Energy Physics. Kiyev, July 15-25, 1959), Moscow, 1961. 739 p. 2,500 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Mezhdunarodnyy Soyuz chistoy i prikladnoy fiziki.

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nucleons, their structure, weak and strong interactions, scattering, and their decay. No personalities are mentioned. References accompany individual articles.

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Pontecorvo, B. Scattering of Pions by Nucleons and Single Production of Pions in Nucleon-Nucleon and Pion-Nucleon Interactions 60

Discussion 118

Segrè, E. Antinucleons and Their Interactions 133

Discussion 152



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"APPROVED FOR RELEASE: 07/13/2001 CIA-RDP86-00513R001342210003-5

AUTHOR: Pontecorvo, B., Corresponding Member of the Academy of Sciences USSR

TITLE: Neutrino, the imperceptible particle

PERIODICAL: Znaniye-sila, no. 2, 1961, 13 - 18

TEXT: The author discusses the nature of elementary particles in general and gives an exhaustive review on neutrinos and antineutrinos.(Table 1). The outstanding feature of the neutrino is its enormous penetrating power due to its weak interaction with nucleons. There are three known types of interactions: electromagnetic, strong and weak interaction. Their intensity is determined by the range of the mean free path of particles inside some substance. In numerous experiments, the first of which being carried out by the Soviet scientist Leypunskiy, it was proved that the summary pulse of electrons and protons during the beta decay of the rest neutron is not zero, which confirmed the neutrino hypothesis, i.e., the assumption that the imperceptible particle carried away the "disappearing" pulse. The "imperceptible" particle was eventually "caught" during the brilliant experiment carried out by American scientists Rayns and Couen in



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Neutrino, the imperceptible particle

1957 with the aid of a 300,000 kw atomic reactor. The experiment was based on the known beta decay reaction, neutron ⟶ proton + electron + antineutron but in reverse form of the beta decay and resulted in the reaction: antineutrino + + proton ⟶ neutron + positron. The antineutron is released during beta decay simultaneously with the electron; during beta-plus decay the proton inside the atomic nucleus converts into neutron, positron and neutrino. To prove that antineutrino and neutrino are indeed different particles with contrasting non-electric neutrino charge, symbols were provided recently by the American physicist [illegible] established that the process antineutrino + chlor 37 ⟶ argon 37 + [illegible] simultaneous disturbance of both laws takes place. The Soviet scientist Landau proved that there is a profounder symmetry in nature, which was called the "combined symmetry". The new law states that any process will remain invariable by simultaneous replacement of right by left and of particle by antiparticle. Ac-

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Neutrino, the imperceptible particle

cordingly, the neutrino beam can be fully polarized and as the neutrino spins from right to left the antineutrino must spin from left to right. This possibility is outlined in the "longitudinal neutrino" theory by Landau, Salam, Lee and Yang. It follows that the mass of neutrinos is equal to zero and that their velocity is equal to that of light. These theories were proved by experiments, as was the fact that neutrinos spin from right to left. Although the polarization of neutrino and antineutrino is high, it is not yet known whether all imperceptible particles were polarized and whether their mass is zero as required by the "longitudinal neutrino" theory. If this requirement is fulfilled then neutrino and antineutrino will differ by the opposite direction of their respective spins. Should this not be the case, than the problem of neutrino charge requires further investigation. One of the main problems of neutrino physics is whether the "imperceptible" particles released with electrons during beta decay and with $\mu$-ions ($\mu$-mesons) during $\pi$-ion ($\pi$-meson) decay are identical. Experiments on this subject are being considered; they would involve powerful accelerators of charged particles to obtain intense $\pi$-ion beams which decay and thereby create mesonic neutrino currents. Another unsolved question is whether a scattering of the neutrino by electrons takes place. Recent experiments proved that the interaction electron-neutrino causes a new loss of energy in stars, linked with the release

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Neutrino, the imperceptuble particle

of neutrino-antineutrino couples. The extraordinary penetrating power of the neutrino suggests the important part played by them in astrophysics. Neutrinos released by stars can be recorded on the earth and may provide valuable data on the universe. In time physicians and astrophysicians will be able to record the intensity of neutrinos and antineutrinos. Some of the solutions are still a long way off but some, e.g., the nature of nuclear reactions inside the sun during which hydrogen converts into helium may be solved in the near future (Fig. 1). The neutrino is directly or indirectly produced by various nuclear processes which determine their energy. The latter is important as it shows that the possibility of interaction (and recording) of neutrinos depends primarily on the energy of "imperceptible"particles in general. It is theoretically known that the sun releases only neutrinos and the task ahead is to determine their number. The particles can be "caught" with the help of the afore-mentioned reaction of neutrinos with the atomic nucleus of chlor-37. The next step will be the investigation of solar radiation. For this purpose the susceptibility of present recording devices must be increased by more than a hundred thousand times. There might exist an anticosmos consisting entirely of antiparticles. The latter, i.e., positrons and antiprotons can be obtained in laboratories by collision of two superenergy protons. However, these artificial antiparticles are of short life



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eutrino, the imperceptible particle

and are quickly annihilated. For this reason the creation of a macroscopic piece of anti-substance on the earth is not possible; obviously they exist only in the universe, in galaxies consisting entirely of anti-substances. The question whether a celestial body consists of substances or anti-substances cannot be answered by terrestrial observations of light and electromagnetic waves. Here, the light released by hydrogen atoms is identical to that of antihydrogen atoms because the light quanta, i.e., photons, are truly neutral and being uncharged, cannot be [illegible] from their antiparticles. Neutrino radiation is different: the sun releases neutrinos and so do all stars deriving energy from thermonuclear reactions during which hydrogen is converted into helium. In an antisun subjected to analogous processes energy would be derived from the conversion of antihydrogen into antihelium although the light would seem the same as normal sunlight and it would release antineutrino instead of neutrino. There are: 1 table and 6 figures.

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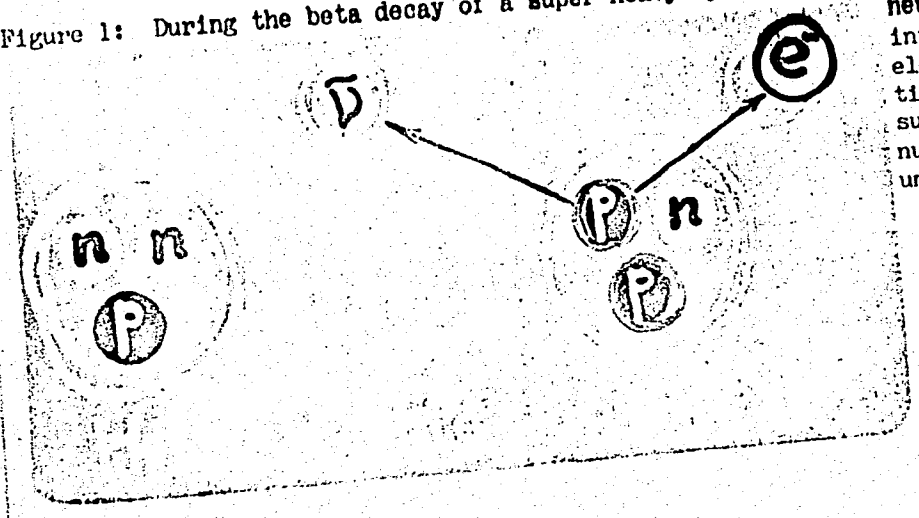
Neutrino, the imperceptible particle

Figure 1: During the beta decay of a super heavy hydrogen nucleus, one of the neutrons converts into a proton, electron and antineutrino, resulting in the nucleus of helium-3.

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Neutrino, the imperceptible particle

Table 1: Elementar particles

| Designation of particles | symbols | electric charge | barion charge | neutron charge | mass (per electron unit) | decay products | designation of interaction causing the decay | approximate life (seconds) | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| photon | $\gamma$ | 0 | 0 | 0 | 0 | | | $\infty$ | leptons |
| neutrino | $\nu$ | 0 | 0 | + | 0 | | | $\infty$ | |
| antineutrino | $\bar{\nu}$ | 0 | 0 | − | 0 | | | $\infty$ | |
| electron | $e^-$ | − | 0 | + | 1 | | | $\infty$ | |
| positron | $e^+$ | + | 0 | − | 1 | | | $\infty$ | |
| negative $\mu$-ion | $\mu^-$ | − | 0 | + | 206 | $e^- + \nu + \bar{\nu}$ | weak cases | $10^{-6}$ | |
| positive $\mu$-ion | $\mu^+$ | + | 0 | − | 206 | $e^+ + \nu + \bar{\nu}$ | weak cases | $10^{-6}$ | |

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A114/A133

Neutrino, the imperceptible particle

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Σ minus ..... | $\Sigma^-$ | − | + | 0 | 2342 | $\pi^- + n$ | CAABOE | $10^{-10}$ | hyperons and antihyperons | baryons and antibaryons |
| anti-Σ minus ..... | $\bar{\Sigma}^+$ | + | − | 0 | 2342 | $\pi^0 + \bar{n}$ | CAABOE | $10^{-10}$ | | |
| Ξ minus ..... | $\Xi^-$ | − | + | 0 | 2585 | $\Lambda^0 + \pi^-$ | CAABOE | $10^{-10}$ | | |
| anti-Ξ minus ..... | $\bar{\Xi}^+$ | + | − | 0 | 2585 | $\bar{\Lambda}^0 + \pi^+$ | CAABOE | $10^{-10}$ | | |
| Ξ zero ..... | $\Xi^0$ | 0 | + | 0 | ? | $\Lambda^0 + \pi^0$ | CAABOE | $10^{-10}$ | | |
| anti-Ξ zero ..... | $\bar{\Xi}^0$ | 0 | − | 0 | ? | $\bar{\Lambda}^0 + \pi^0$ | CAABOE | $10^{-10}$ | | |

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AUTHOR: [illegible]

TITLE: The neutrino and the density of matter in the universe

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 41, no. 1(7), 1961, 239 - 243

TEXT: No estimations regarding the neutrino-antineutrino density in the universe have hitherto been made; there is, however, reason to believe that it is remarkable, due to the fact that these particles are hardly absorbed in dense matter. The authors now raise the question: Is it possible that the energy pertaining to the neutrinos and antineutrinos is comparable with or greater than the energy corresponding to the rest mass of hydrogen? It was the aim of the present investigations to find an answer to this question. The assumption of a high neutrino-antineutrino energy density is not imcompatible with available experimental data, but these depend essentially on the cosmogonic model. Some methods are now discussed, which might help to verify this assumption,

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The neutrino and the density ...

which is in itself a consequence of the PC asymmetry of the universe and of the hypothesis of the existence of anti-worlds. The methods referred to consist preponderantly in investigating cosmic radiation and its interaction with matter, as well as the well-known experiments carried out by Reines, Cowan, and Davis with a reactor. They confirm the existence of anti-neutrinos with energies varying from 3 to 10 Mev. The tests showed that the flux of antineutrinos exhibiting energies from 3 to 10 Mev is not likely to exceed the value $10^{13}$ $cm^{-2}$ $sec^{-1}$ essentially in the cosmic space. This corresponds to a maximum energy density of antineutrinos of these energies amounting to $\sim 10^3$ Mev/$cm^3$. These experiments supply, however, no information on the $\tilde{\nu}$ density if $E_\nu \gg 10$ Mev. The Davis experiments disclosed that the cosmic neutrino density (neutrinos exhibiting energies of several Mev) cannot exceed some [illegible]

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The neutrino and the density ...

density of $\lesssim 10^{-1}$ Mev/cm is obtained, which is comparable with $W_H^{max}$. In this connection, it is important to take the meaning of the $(e\nu)$ $(e\bar{\nu})$ Fermi interaction into account, which guarantees an energy transfer to the $\nu\bar{\nu}$ component. Attention is drawn to the fact that the small magnitude of the "visible" kinetic-energy density (which is much smaller than the energy density corresponding to the rest mass of the nucleons) is not contradictory to the hypothesis of separation of matter from anti-matter as a result of fluctuations occurring in a charge-symmetrical universe. The fluctuation hypothesis only presupposes the assumption that once in the past the $\nu\bar{\nu}$ energy density exceeded the nucleon-energy density by several orders of magnitude. The authors thank A. G. Masevich and S. B. Pikel'ner for discussions. There are 15 references: 6 Soviet-bloc and 9 non-Soviet-bloc. The most important references to English-language publications read as follows: H. Y. Chiu, R. Stabler. Neutrino Emission Processes and Stellar Evolution, preprint, 1960; F. Reines, C. L. Cowan. Proc. of the 2-nd Intern. Conf. on the Peaceful Uses of Atomic Energy, Geneva, 1958; R. Davis. Bull. Amer. Phys. Soc., 4, 217, 1959; G. E. P. George, I. Evans. Proc. Phys. Soc., A 63, 1248, 1950; A 64,

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The neutrino and the density ...

193, 1951; T. D. Lee, L. N. Yang. Phys. Rev. Lett., 4, 307, 1960;
N. Gabbibo, R. Gatto. Nuovo Cim., 15, 304, 1960.

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy
(Joint Institute of Nuclear Research)

SUBMITTED: February 7, 1961

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24.6600

AUTHORS: Zaymidoroga, O. A., Kulyukin, M. M., Pontekorvo, B., Sulyayev, R. M., Filippov, A. I., Tsupko-Sitnikov, V. M., Shcherbakov, Yu. A.

TITLE: Observation of the reaction $\mu^- + He^3 \rightarrow H^3 + \nu$

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 41, no. 6(12), 1961, 1804-1806

TEXT: The probability of slow $\mu^-$-meson capture by $He^3$ is known from highly accurate theoretical calculations. From probability measurements of the reaction $\mu^- + He^3 \rightarrow H^3 + \nu$ the muon-nucleon interaction constant can be determined and the results compared with those of the weak interaction theory. From the tritium energy in this process the upper limit of the neutral particle mass emitted in muon capture can be estimated and the probability of the process $\mu^- + p \rightarrow n + \nu$, not yet observed with certainty, can be determined. The first results of investigation of muon capture by $He^3$ are dealt with. A diffusion chamber filled with pure (99.999%) $He^3$ at

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Observation of the reaction ...

20 atm, was placed in a field of 6000 oe and exposed to a muon beam (momentum 217 Mev/c) from the synchrocyclotron of the OIYaI. The methyl alcohol pressure in the sensitive layer of the chamber was less than 50 mm Hg, the tritium content of the gas used was $10^{-15}$. A copper filter was put in the chamber to slow down the mesons and eliminate the pions. The chamber was carefully shielded from thermal neutrons. To date, about 6000 photographs have been taken of events where the muon path stopped at a $He^3$ nucleus. The reactions sought were identified by the energy of the tritium nucleus. From the pion admixture 1200 stars were observed. The admixture was determined to $\sim 2\%$, causing $\pi^- + He^3 \longrightarrow H^3 + \int^{\wedge}$ reactions. 14 events of the $\mu^- + He^3 \longrightarrow H^3 + \nu$ reaction were identified, the mean tritium range was $2.37 \pm 0.02$ mg/cm$^2$. The upper limit of the neutral particle emitted in muon capture was estimated: With 99% probability its mass is less than 6 Mev. The charged particle masses were: $m_{He^3} = 2808.22$ Mev, $m_{H^3} = 1808.75$ Mev, $m_\mu = 105.65$ Mev. The probability of reaction (1) was $(1.30 \pm 0.40) \cdot 10^3$ sec$^{-1}$. The value calculated by Wolfenstein on the basis of the theory of universal

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Observation of the reaction ...

weak interaction was $(1.54\pm0.08)\cdot10^3 sec^{-1}$. The constant of vectorial μN interaction was estimated roughly: With a probability of 90%, $|g_V^\mu| < 2|g_A^\mu|$. The authors thank P. L. Kapitsa, V. P. Peshkov, V. M. Kuznetsov and A. I. Filimonov for the purification of the $He^3$ from $H^3$ carried out in the IFP AN SSSR, S. S. Gershteyn for discussions, V. P. Dzhelepov, L. I. Lapidus for interest and G. M. Aleksandrov, V. V. Kuznetsov, N. V. Lebedev, V. I. Orekhov, V. F. Poyenko, A. G. Potekhin, D. B. Pontekorvo and I. V. Falomkin for experimental help. There are 2 figures and 12 references: 4 Soviet and 8 non-Soviet. The four most recent references to English-language publications read as follows: S. Weinberg. Phys. Rev. Lett. 4, 575, 1960; J. C. Fetkovich et al. Phys. Rev. 118, 319, 1960; E. J. Maier et al. Phys. Rev. Lett. 6, 417, 1961; L. Wolfenstein. Proc. of the 1960 Ann. Int. Conf. on High Energy Phys. of Rochester, Univ. of Rochester, 1960, p. 529; Bull. Amer. Phys. Soc., 6, 33, 1961.

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"APPROVED FOR RELEASE: 07/13/2001 CIA-RDP86-00513R001342210003-5

PONTECORVO, B. M.

"Small Probability of the Processes and Symmetrical Neutral Currents in Weak Interactions"

Report presented at the Intl. Conference on High Energy Physics, Geneva, 4-11 July 1962

Joint Inst. for Nuclear Research, Lab of Nuclear Problems

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PONTEKORVO, B.M.

FILIPPOV, A.I., KULYUKIN, M.M., PONTEKORVO, B.M., SHCHERBAKOV, Yu.A., SULYAYEV, R.M., ZAYMIDOROGA, O.G.

"Observation of the Reaction $\bar{H} + He^3 \rightarrow H^3 + \nu$"

report presented at the Intl. Conference on High Energy Physics, Geneva, 4-11 July 1962

Joint Institute for Nuclear Research
Laboratory of Nuclear Problems

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FALOMKIN, I.V., FILIPPOV, A.I., [illegible], PONOMAREVA, B.M., SOKOLSKAYA, N.A., SULYAYEV, R.M., TSUPKO-SITNIKOV, V.M., [illegible]

"Muon-Nucleon Interaction Constants and Muon Capture in $He^3$"

report presented at the Intl. Conference on High Energy Physics, Geneva, 4-11 July 1962

Joint Institute for Nuclear Research
Laboratory of Nuclear Problems

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"APPROVED FOR RELEASE: 07/13/2001 CIA-RDP86-00513R001342210003-5

report presented at the 11th Intl. Conference on High Energy Physics,
Geneva, 4-11 July 1962

Joint Inst. Nuclear Research, Lab. of Nuclear Problems

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PONTEKORVO, B.

Neutrinos and their role in astrophysics. Vop.kosm. 9:132-156 '63.
(MIRA 17:5)

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B104/B186

AUTHOR: Pontekorvo, B.

TITLE: The small probability of the $\mu \rightarrow e + \gamma$, $\mu \rightarrow e + e + e$ processes and the neutral fluxes in weak interactions

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 43, no. 4(10), 1962, 1521-1523

TEXT: The present paper discusses the results of a great number of Western and Russian works on processes indicated in the title. The author dwells particularly on the theory developed by R. P. Feynman and M. Gell-Mann (Phys. Rev., 109, 193, 1958). He shows that the simple concept of this theory to account for diagonal terms of the type $(\bar{e}\nu)(\bar{\nu}e)$ being absent from the Lagrangian of weak interaction is so unnatural, that the concept of interaction between the fluxes as a source of weak four-fermion interaction had to be dropped. However, the evaluation of a suggestion made by S. Bludman (Nuovo Cim., 9, 433, 1958) opens a way to maintaining this concept. Bludman assumes that the Lagrangian of weak interaction consists of two sections: one,



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S/056/63/044/001/067/067
B102/B186

AUTHORS: Zaymidoroga, O. A., Kulyukin, M. M., Pontekorvo, B., Sulyayev, R. M., Falomkin, I. V., Filippov, A. I., Tsupko-Sitnikov, V. M., Shcherbakov, Yu. A.

TITLE: Measurement of the $\mu^- + He^3 \rightarrow H^3 + \nu$ reaction probability. Final results

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 44, no. 1, 1963, 389 - 390

TEXT: The $\mu^- + He^3$ reaction probability was determined from about 200 events observed in a $He^3$ diffusion chamber. Experimental method, and the scanning and evaluation procedures used were the same as those described in ZhETF, 43, 355, 1962. The final experimental result is $\Lambda_{He^3} = (1.41 \pm 0.14) \cdot 10^3$ sec$^{-1}$. It agrees with the previously published one which was calculated from the data of 90 events. There is 1 table.

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy (Joint Institute of Nuclear Research)

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S/053/63/079/001/001/003
B102/B186

AUTHOR: Pontekorvo, Bruno

TITLE: The neutrino and its role in astrophysics

PERIODICAL: Uspekhi fizicheskikh nauk, v. 74, no. 1, 1963, 3-21

TEXT: This article, a reproduction of a lecture held in July 1962 in Tartu, reports on the properties of the neutrino, on its production and decay, its interaction, and its role in astrophysics and cosmogony. Well-known problems are discussed in detail: such as whether four-fermion interaction is primary, whether the neutrino is a $\nu_e$ or a $\nu_\mu$ particle, whether there exists an anomalous $\nu_\mu$-N interaction, whether there exists $\nu$-e interaction, whether there are neutral currents in weak interaction. The Sun and stars of not too high temperatures and densities emit neutrinos of different spectra generated in the energy producing nuclear cycles. The neutrino flux from the Sun to the Earth amounts to

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AMBARTSUMYAN, V.A., akademk; GINZBURG, V.L.; ZEL'DOVICH, Ya.B., akademik; PONTEKORVO, B.M.; SMORODINSKIY, Ya.A., doktor fiz.-matem. nauk, prof.; FOK, V.A., akademik, CHERNOV, A.G.; FAYNBOYM, I.B., red.

[Birth and evolution of the galaxies and stars; the third discussion] Rozhdenie i evoliutsiia galaktik i zvezd; beseda tret'ia. [By] V.A.Ambartsumian i dr. Moskva, Izd-vo "Znanie," 1964. 27 p. (Novoe v zhizni, nauke, tekhnike. Seriia IX: Fizika, matematika, astronomiia, no.12)
(MIRA 17:6)

1. Chlen-korrespondent AN SSSR (for Ginzburg, Pontekorvo).

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L 2734-66 EWT(m) DIAAP

ACCESSION NR: AP5024338 UR/0367/65/002/002/0257/0260

15
12
B

AUTHOR: Gershteyn, S.; Pontekorvo, B.

TITLE: Mesic atom production during decay of heavy hypernuclei. 19

SOURCE: Yadernaya fizika, v. 2, no. 2, 1965, 257-260

TOPIC TAGS: heavy nucleus, muon, particle production, hypernucleus

ABSTRACT: Muon decay of heavy hyperfragments is theoretically studied. It is assumed that a muon appears in the bound state of the mesic atom when a heavy Λ-hyperfragment is exposed to radiation by antineutrinos with discrete energy. This process is relatively probable since the radius of the muon orbit in the mesic atom is much less than the radius of the corresponding electron orbit in the atom, and the Pauli exclusion principle does not prohibit the production of a muon in the $1S$-state of any mesic atom. Muon $K$-production of a free Λ-particle is considered. It is shown that the probability of muon production as discrete μ-mesic atoms is comparable to the probability of continuous spectrum production. It is found that muon $L$-production isin the $2S$-state in heavy hyperfragments is of the same order of

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ACCESSION NR: AP5024338

3

magnitude as $K$-production. Experiments are suggested for verifying the theoretical muon $K$- and $L$-production in heavy nuclei. "In conclusion, it gives us pleasure to thank S. M. Bilen'kiy and M. Ya. Danysh for consultation." Orig. art. has: 9 formulas.

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy (Joint Institute of Nuclear Research)

SUBMITTED: 06Mar65 ENCL: 00 SUB CODE: NP

NO REF SOV: 002 OTHER: 004

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Card 2/2

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L 1889-66 EWT(1)/EWT(m)/T/EWA(m)-2 GS/GW
ACCESSION NR: AT5022823 UR/0000/65/000/000/0023/0041

27
25
B41

AUTHOR: Pontekorvo, Bruno

TITLE: The neutrino and its role in astrophysics

SOURCE: Vsesoyuznoye soveshchaniye po kosmofizicheskomu napravleniyu issledovaniy kosmicheskikh luchey. 1st, Yakutsk, 1962. Kosmicheskiye luchi i problemy kosmofiziki (Cosmic rays and problems in cosmophysics); trudy soveshchaniya. Novosibirsk, Redizdat Sib. otd. AN SSSR, 1965, 23-41

TOPIC TAGS: neutrino, astrophysics, cosmology, antineutrino

ABSTRACT: [illegible] many questions that are qualitative in character which have no "yes" or "no" answers; the origin of these problems and the planned methods for an experimental solution are presented. After surveying the known properties of the neutrino, the author discusses the following questions: (1) Is the four-fermion interaction a primary one? (2) Are $\nu_e$ and $\nu_\mu$ identical particles? (3) Is there an anomalous $\nu_\mu$-N interaction? (4) Is there a $\nu$-e interaction? (5) Are there neutral currents in weak interactions? Other problems considered include: certain macroscopic effects connected with the neutrino, the neutrino and the

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L 1889-66
ACCESSION NR: AT5022823

2

sun, radiation of neutrino-antineutrino pairs associated with the electron-neutron interaction, neutral currents and astrophysics, and neutrino and cosmogony. A detailed discussion of experimental neutrino astronomy is given. Orig. art. has: 3 figures, 2 tables, and 4 formulas.

ASSOCIATION: Mezhdunarodnyy institut yadernykh issledovaniy, Dubna (International Institute for Nuclear Studies)

SUBMITTED: 29Oct64 ENCL: 00 SUB CODE: AA, NP

NO REF SOV: 024 OTHER: 029

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"APPROVED FOR RELEASE: 07/13/2001 CIA-RDP86-00513R001342210003-5

PONTEKORVO, Bruno

Physics of elementary particles, a costly matter: is it needed?
Usp. fiz. nauk 86 no.4:729-732 Ag '65.

(MIRA 18:8)

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"APPROVED FOR RELEASE: 07/13/2001 CIA-RDP86-00513R001342210003-5

ACC NR: AP7011838 SOURCE CODE: UR/0367/66/004/006/1202/1206

AUTHOR: Okun', L.; Pontekorvo, B.; Rubbia, K.

ORG: Joint Institute for Nuclear Research (Ob"yedinennyy institut yadernykh issledovaniy)

TITLE: Four-lepton decays of pi minus and k-mesons and possible anomalous interactions of leptons

SOURCE: Yadernaya fizika, v. 4, no. 6, 1966, 1202-1206

TOPIC TAGS: pi meson, K meson, lepton, radioactive decay

SUB CODE: 20,18

ABSTRACT: Four-leptonic decays of the type $\pi \rightarrow e\nu e^+e^-$ and $K \rightarrow e\nu\mu^+\mu^-$ are discussed with the aim of determining whether their experimental investigations can give information on the validity limits of quantum electrodynamics and on the possibility that there exist additional interactions of leptons of the type $(\bar{e}e)(\bar{e}e)$, $(\bar{\mu}\mu)(\bar{\mu}\mu)$, or $(\bar{e}e)(\bar{\mu}\mu)$. It is shown that available experimental data on the validity of quantum electrodynamics require the branching ratios of $\pi \rightarrow e\nu e^+e^-$ and $K \rightarrow e\nu\mu^+\mu^-$ to be less than $10^{-9}$ of the total decay rates of $\pi$ and K mesons.

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ACC NR: AP7011838

The authors thank I. Yu. Kobzarev, S. M. Korenchenko, L. I. Lapidus, A. I. Mukhin, and V. I. Petrukhin for interesting discussions. Orig. art. has: 4 figures, 23 formulas and 1 table. [Based on authors' Eng. Abst.] [JPRS: 40,423]

Card 2/2

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PONTEKORVO, B.M.

Analysis of the conical reprojection of spark-chamber stereoscopic photographs in determining the momentum of charged particles moving in a magnetic field. Prib. i tekh. eksp. 9 no.4:66-70 Jl-Ag '64. (MIRA 17:12)

1. Ob"yedinennyy institut yadernykh issledovaniy.

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L 8583-65 EWT(1)/EWT(m)/T/EED(b)-3 Pae-2 DIAAP/IJP(c)/AEDC(a)/ASD(a)-5/SSD AFMDC/AFWL/ASD(p)-3/BSD/RAEM(c)/ESD(t)/RAEM(t)

ACCESSION NR: AP4048497 S/0120/64/000/004/0066/0070

AUTHOR: Pontekorvo, D. B.

TITLE: Calculation of the conical reprojection of chamber stereophotographs during determination of the pulses of charged particles moving in a magnetic field

SOURCE: Pribory* i tekhnika eksperimenta, no. 4, 1964, 66-70

TOPIC TAGS: chamber stereophotograph, charged particle, charged particle pulse, magnetic field, conical reproduction, conical reprojection, stereoscopic photograph

Abstract: The article analyzes the conical reproduction of chamber stereophotographs during determination of the pulses of charged particles moving in a magnetic field. The case is considered in which the action of the camera and the reprojection of the stereoscopic photographs are produced by identical objectives, the optical axes of which are parallel to the magnetic field. Correlations are obtained which make it possible, according to the size of the measured radius of curvature of the projection of a particle trace, to compute the radius of curvature of the orthogonal projection. The author thanks I. N. Silin, R. M. Sulyayev and I. V. Falomkin for assistance and consultation; Ye. B. Boyadzhiyev, L. Ye. Nal'tsev and A. V. Rokitskiy, for computations performed. There are five figures.

Card 1/2

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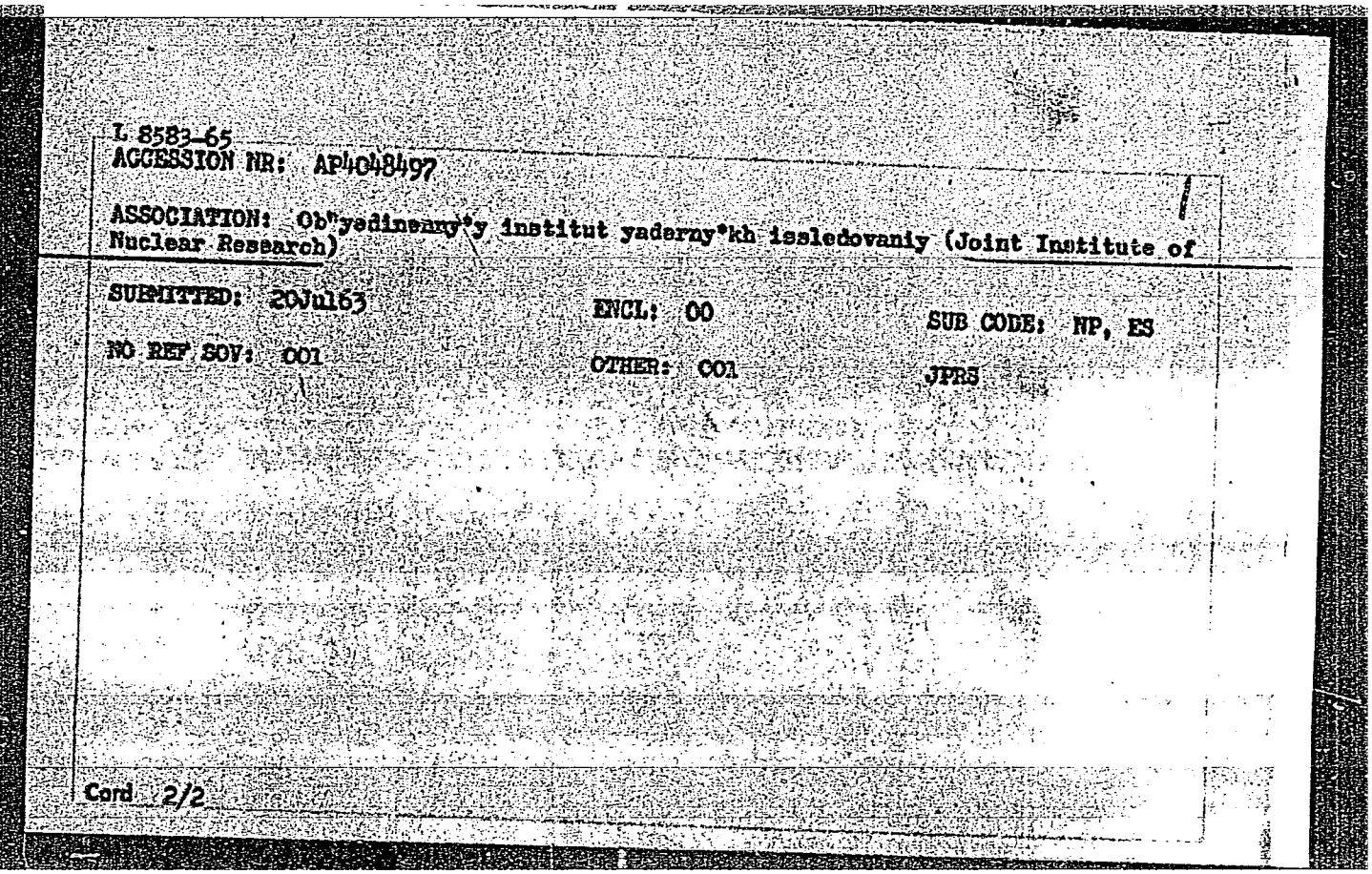

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ACCESSION NR: AP4048497

ASSOCIATION: Ob"yedinennyy institut yaderny*kh issledovaniy (Joint Institute of Nuclear Research)

SUBMITTED: 20Jul63 ENCL: 00 SUB CODE: NP, ES

NO REF SOV: 001 OTHER: 001 JPRS

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"APPROVED FOR RELEASE: 07/13/2001 CIA-RDP86-00513R001342210003-5

ZAYMIDOROGA, O.A.; KULYUKIN, M.M., PONTEKORVO, B.; SULYAYEV, R.M.; FALOMKIN, I.V.; FILIPPOV, A.I.; TSUPKO-SITNIKOV, V.M.; SHCHERBAKOV, Yu.A.

Measurement of the total probability of muon capture in $He^3$. Zhur. eksp. i teor. fiz. 45 no.6:1803-1807 D '63. (MIRA 17:2)

1. Ob"yedinennyy institut yadernykh issledovaniy.

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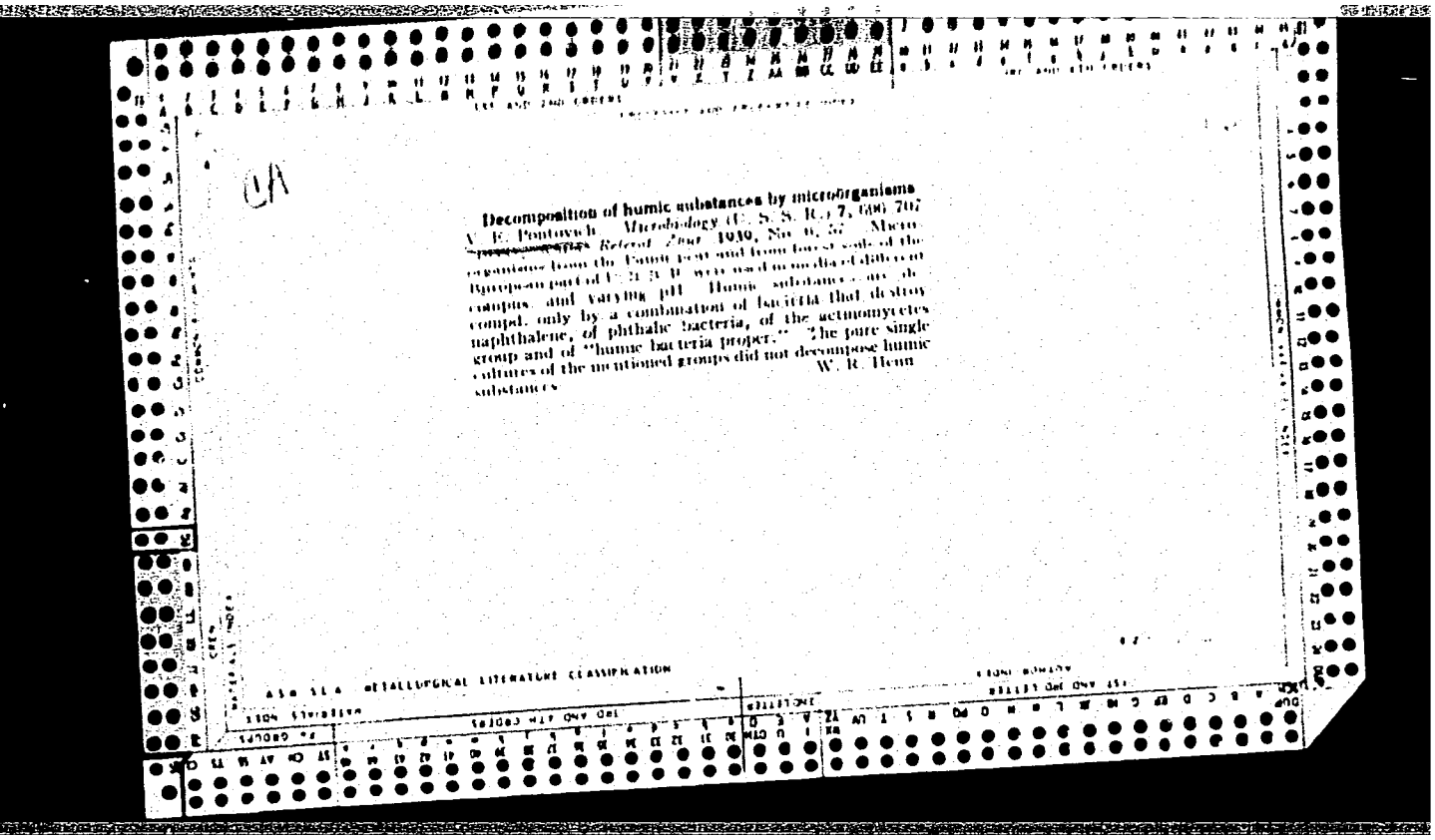

**Decomposition of humic substances by microorganisms**

V. E. Pontovich *Microbiology* (U. S. S. R.) 7, 680 707 (1938). Received June 1939. No. 6, 5c. Micro-organisms from the Donet peat and from forest soils of the Bjorkpesan part of U. S. S. R. were used in studies of different compos. and varying pH. Humic substances are decompd. only by a combination of bacteria that destroy naphthalene, of phthalic bacteria, of the actinomycetes group and of "humic bacteria proper." The pure single cultures of the mentioned groups did not decompose humic substances.

W. R. Henn

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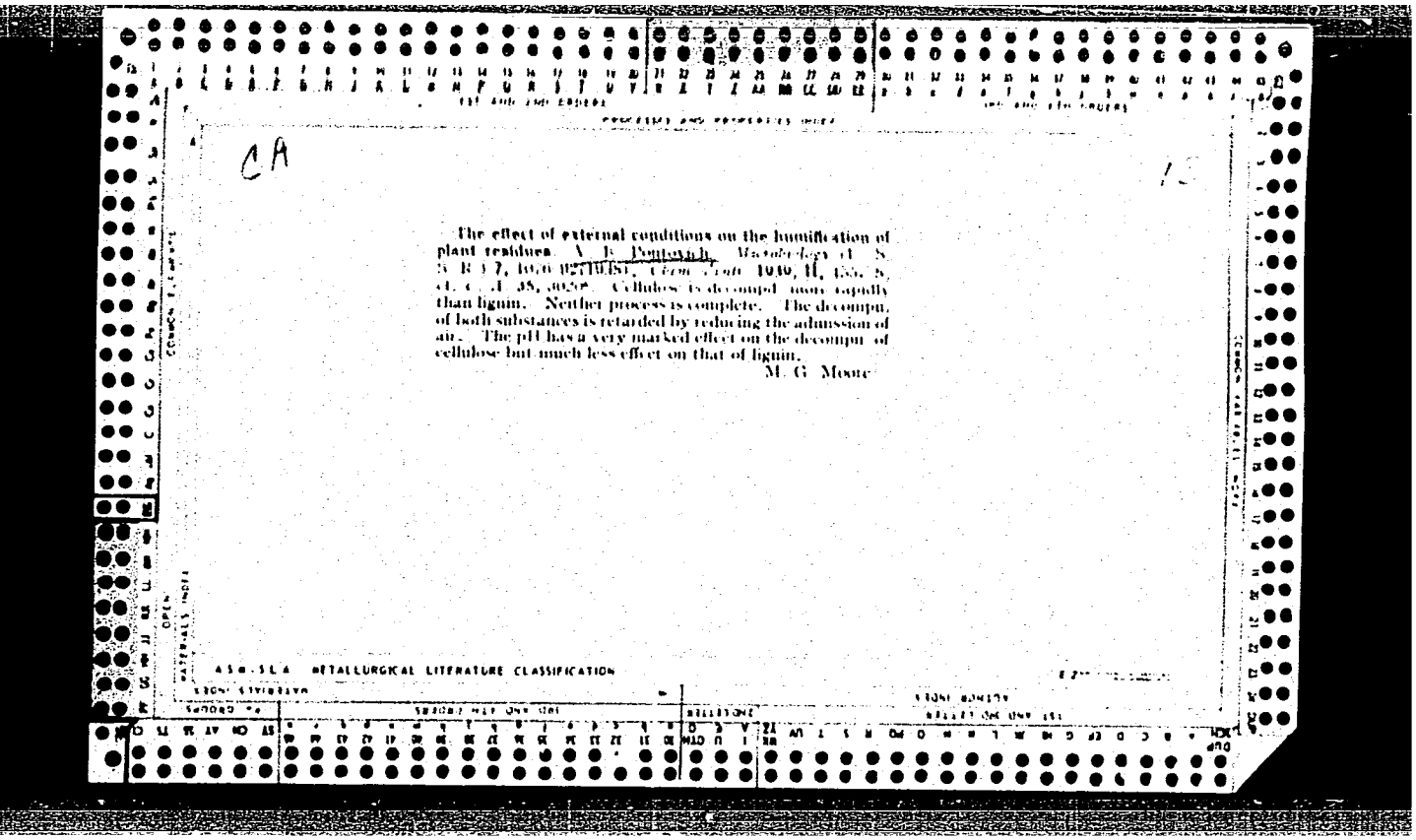

CA

The effect of external conditions on the humification of plant residues. V. I. Pomerants. Mashinostroenie (U. S. S. R.) 7, 10(6 pp.)(1938). Chem. Abs. 1940, II, 155. S. cf. C. A. 35, 3058. Cellulose is decomposed more rapidly than lignin. Neither process is complete. The decompn. of both substances is retarded by reducing the admission of air. The pH has a very marked effect on the decompn. of cellulose but much less effect on that of lignin.

M. G. Moore

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

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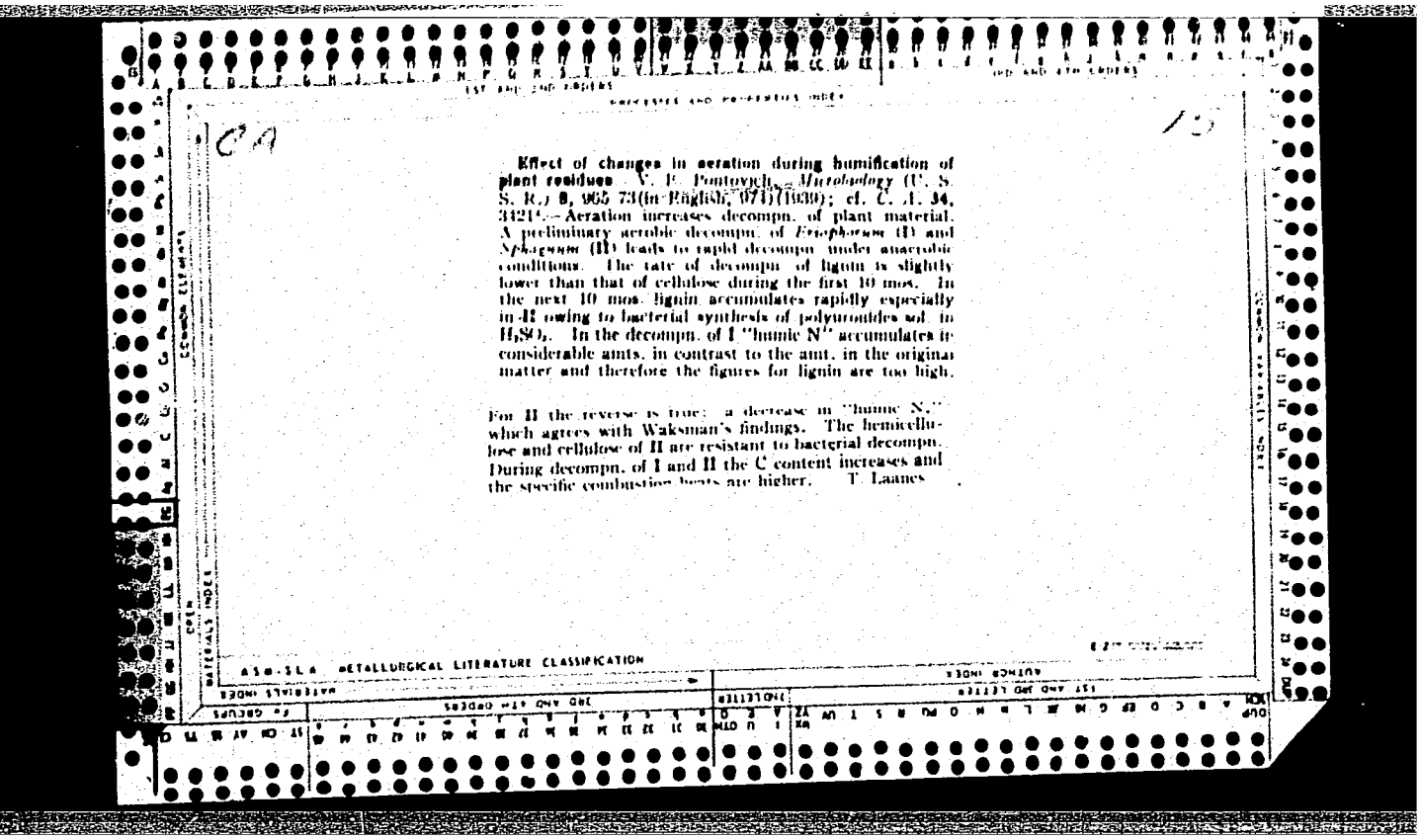

**Effect of changes in aeration during humification of plant residues.** V. P. Pontovich. *Microbiology* (U. S. S. R.) **8**, 965-73 (in English, 971) (1939); cf. *C. A.* **34**, 3121⁴.—Aeration increases decompn. of plant material. A preliminary aerobic decompn. of *Eriophorum* (I) and *Sphagnum* (II) leads to rapid decompn. under anaerobic conditions. The rate of decompn. of lignin is slightly lower than that of cellulose during the first 10 mos. In the next 10 mos. lignin accumulates rapidly especially in II owing to bacterial synthesis of polyuronides sol. in $H_2SO_4$. In the decompn. of I "humic N" accumulates in considerable amts. in contrast to the amt. in the original matter and therefore the figures for lignin are too high.

For II the reverse is true; a decrease in "humic N," which agrees with Waksman's findings. The hemicellulose and cellulose of II are resistant to bacterial decompn. During decompn. of I and II the C content increases and the specific combustion heats are higher. T. Laanes

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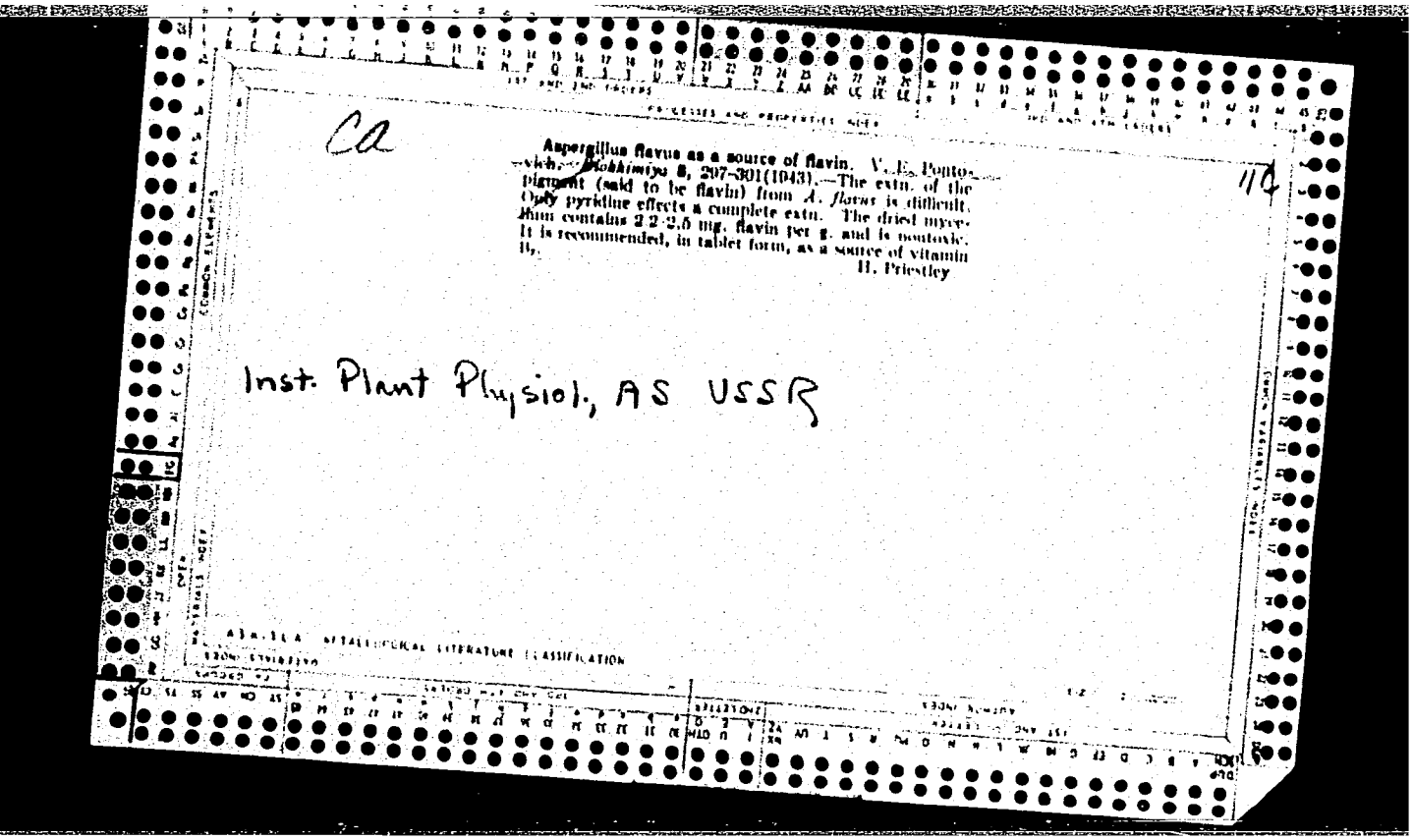

Ca

**Aspergillus flavus as a source of flavin.** V. L. Ponto-vich. *Biokhimiya* **8**, 297-301(1943).—The extn. of the pigment (said to be flavin) from *A. flavus* is difficult. Only pyridine effects a complete extn. The dried myce-lium contains 2.2-2.6 mg. flavin per g. and is nontoxic. It is recommended, in tablet form, as a source of vitamin $B_2$.
H. Priestley

114

Inst. Plant Physiol., AS USSR

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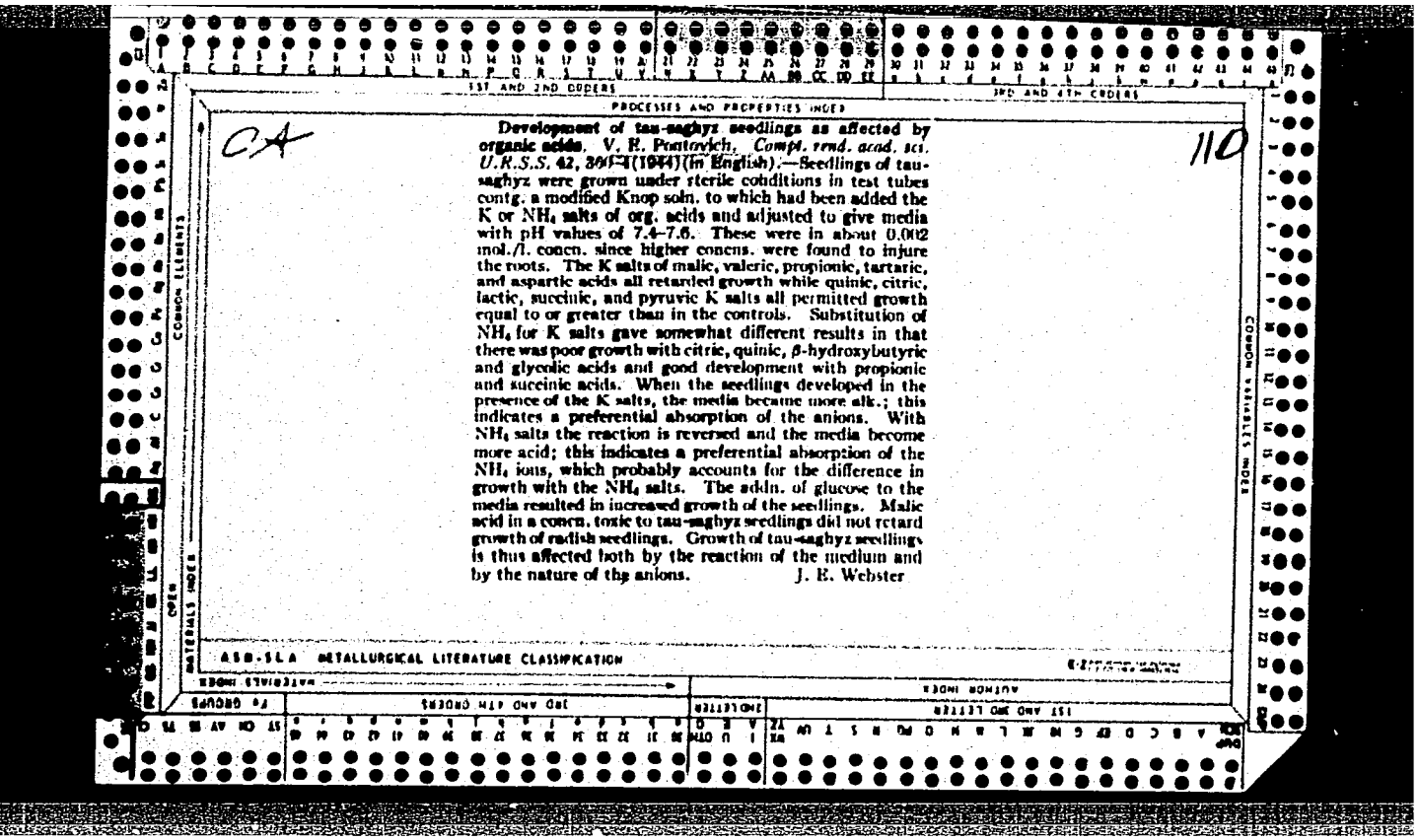

CA

110

**Development of tau-saghyz seedlings as affected by organic acids.** V. E. Pantovich. *Compt. rend. acad. sci. U.R.S.S.* 42, 39[illegible](1944)(in English).—Seedlings of tau-saghyz were grown under sterile conditions in test tubes contg. a modified Knop soln. to which had been added the K or $NH_4$ salts of org. acids and adjusted to give media with pH values of 7.4–7.6. These were in about 0.002 mol./l. concn. since higher concns. were found to injure the roots. The K salts of malic, valeric, propionic, tartaric, and aspartic acids all retarded growth while quinic, citric, lactic, succinic, and pyruvic K salts all permitted growth equal to or greater than in the controls. Substitution of $NH_4$ for K salts gave somewhat different results in that there was poor growth with citric, quinic, β-hydroxybutyric and glycolic acids and good development with propionic and succinic acids. When the seedlings developed in the presence of the K salts, the media became more alk.; this indicates a preferential absorption of the anions. With $NH_4$ salts the reaction is reversed and the media become more acid; this indicates a preferential absorption of the $NH_4$ ions, which probably accounts for the difference in growth with the $NH_4$ salts. The addn. of glucose to the media resulted in increased growth of the seedlings. Malic acid in a concn. toxic to tau-saghyz seedlings did not retard growth of radish seedlings. Growth of tau-saghyz seedlings is thus affected both by the reaction of the medium and by the nature of the anions. J. E. Webster

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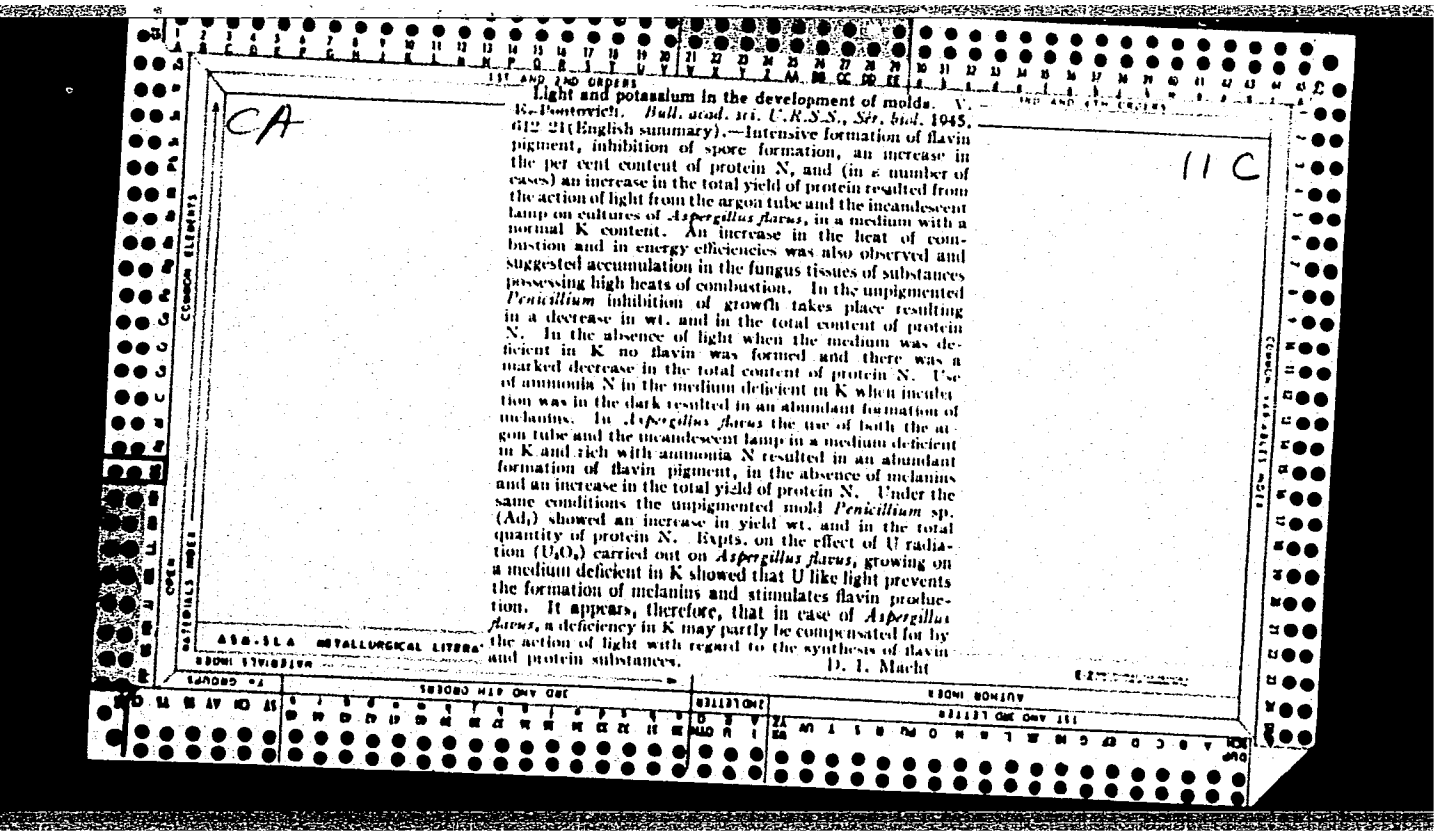

CA

11 C

**Light and potassium in the development of molds.** V. —Pentovich. *Bull. acad. sci. U.R.S.S., Sér. biol.* 1945, 612-21(English summary).—Intensive formation of flavin pigment, inhibition of spore formation, an increase in the per cent content of protein N, and (in a number of cases) an increase in the total yield of protein resulted from the action of light from the argon tube and the incandescent lamp on cultures of *Aspergillus flavus*, in a medium with a normal K content. An increase in the heat of combustion and in energy efficiencies was also observed and suggested accumulation in the fungus tissues of substances possessing high heats of combustion. In the unpigmented *Penicillium* inhibition of growth takes place resulting in a decrease in wt. and in the total content of protein N. In the absence of light when the medium was deficient in K no flavin was formed and there was a marked decrease in the total content of protein N. Use of ammonia N in the medium deficient in K when incubation was in the dark resulted in an abundant formation of melanins. In *Aspergillus flavus* the use of both the argon tube and the incandescent lamp in a medium deficient in K and rich with ammonia N resulted in an abundant formation of flavin pigment, in the absence of melanins and an increase in the total yield of protein N. Under the same conditions the unpigmented mold *Penicillium* sp. (Ad$_1$) showed an increase in yield wt. and in the total quantity of protein N. Expts. on the effect of U radiation ($U_3O_8$) carried out on *Aspergillus flavus*, growing on a medium deficient in K showed that U like light prevents the formation of melanins and stimulates flavin production. It appears, therefore, that in case of *Aspergillus flavus*, a deficiency in K may partly be compensated for by the action of light with regard to the synthesis of flavin and protein substances.

D. I. Macht

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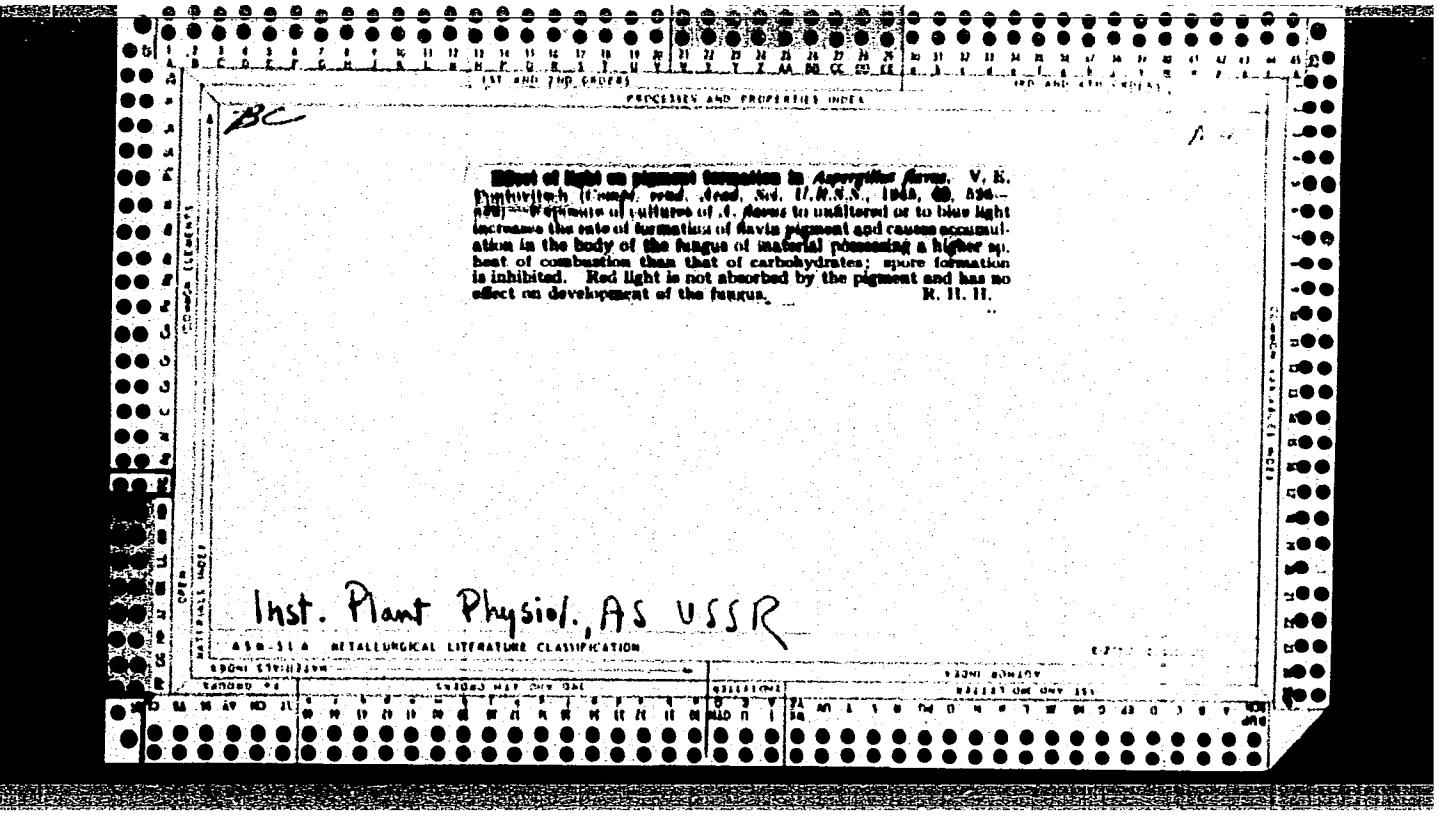

PROCESSES AND PROPERTIES INDEX

BC

Effect of light on pigment formation in *Aspergillus flavus*. V. E. Pinkevitch (Compt. rend. Acad. Sci. U.R.S.S., 1948, 60, 836—838).—Exposure of cultures of *A. flavus* to unfiltered or to blue light increases the rate of formation of flavin pigment and causes accumulation in the body of the fungus of material possessing a higher specific heat of combustion than that of carbohydrates; spore formation is inhibited. Red light is not absorbed by the pigment and has no effect on development of the fungus. R. H. H.

Inst. Plant Physiol., AS USSR

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

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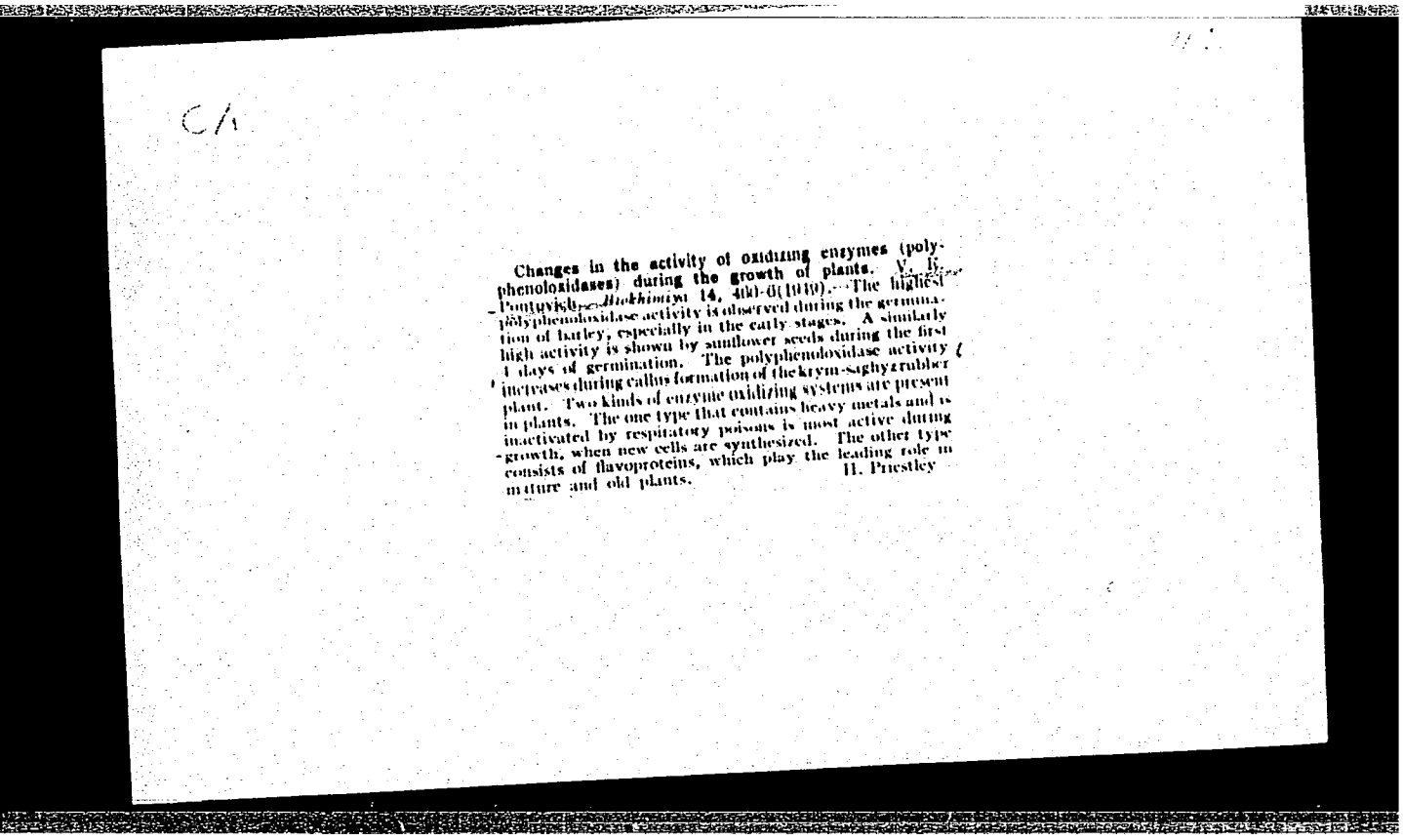

CA

**Changes in the activity of oxidizing enzymes (polyphenoloxidases) during the growth of plants. V. Iv.** Pentyush. *Biokhimiya* 14, 400-6(1949).—The highest polyphenoloxidase activity is observed during the germination of barley, especially in the early stages. A similarly high activity is shown by sunflower seeds during the first 4 days of germination. The polyphenoloxidase activity increases during callus formation of the krym-saghyz rubber plant. Two kinds of enzyme oxidizing systems are present in plants. The one type that contains heavy metals and is inactivated by respiratory poisons is most active during growth, when new cells are synthesized. The other type consists of flavoproteins, which play the leading role in mature and old plants. H. Priestley

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"APPROVED FOR RELEASE: 07/13/2001 CIA-RDP86-00513R001342210003-5

FONTOVICH, V. E.

"Nitrification Under Conditions Obtaining in High-Mountain Regions," Trudy Inst Fiziologii Rasteniy im. K. A. Timiryazeva, (Works of the Institute of Plant Physiology imeni K. A Timiryazev), 1950, Vol VII, No. 1.

Mikrobiologiya, Vol XX, No. 5, 1951
-W-24635

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"APPROVED FOR RELEASE: 07/13/2001 CIA-RDP86-00513R001342210003-5

PONTOVICH, V. E.

"On the Possibility of Utilizing Carbon Dioxide in the Synthetic Processes of Heterotrophic Organisms," Iz. Ak Nauk SSSR, Ser. Biol., No 5, pp 120-135, 1951

Translation M-515, 3 June 55

APPROVED FOR RELEASE: 07/13/2001 CIA-RDP86-00513R001342210003-5"

"APPROVED FOR RELEASE: 07/13/2001 CIA-RDP86-00513R001342210003-5

PONTOVICH V.E.

PONTOVICH,V.E.

Nature of gas relations and respiration in the bolls of poppies. Fiziol.rast. 1 no.2:131-140 N-D '54. (MLRA 8:10)

1. Institut fiziologii rasteniy imeni K.A.Timiryazeva Akademii nauk SSSR, Moscow

(Plants, Gases in) (Poppy)

APPROVED FOR RELEASE: 07/13/2001 CIA-RDP86-00513R001342210003-5"

"APPROVED FOR RELEASE: 07/13/2001 CIA-RDP86-00513R001342210003-5

PONTOVICH, V.E.

Effect of carbon dioxide on the activity of oxidizing enzymes of kok-saghyz roots during postharvest storage. Trudy Inst.fiziol. rast. 8 no.2:194-214 '54. (MLRA 8:5)

1. Institut fiziologii rasteniy im. K.A.Timiryazeva Akademii nauk SSSR.

(Kok-saghyz) (Plants, Effect of carbon dioxide on)

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Pontovich V.E.

V The use of carbon-14 in study of physiology of fruit or oil-bearing plants. V. E. Pontovich. *Sessiya Akad. Nauk SSSR po Mirnomu Ispol'zovaniyu Atomnoi Energii 1955, Zasedaniya Otdel. Biol. Nauk*, 254–67(English summary, 268-9).—The intercellular matter of poppy pods contains O 9–10 and $CO_2$ 11–12%; the central space within the pods in which the seeds are formed contains $CO_2$ 1 and O 18–19%; the peculiarity of this structure is also the vigorous gas exchange between the central cavity and the atm. Both under light and in the dark $C^{14}$-labeled $CO_2$ tracing permitted the establishment of the fact that the $CO_2$ entering the cavity is assimilated in the walls and then passes into the placenta and the seeds; $C^{14}$ is later found in $CO_2$ in the central cavity as a result of respiration of the seeds. Labeled $CO_2$ occurs in the intercellular spaces of the placenta as a result of its cleavage from the placental products. In illumination the highest $C^{14}$ activity is found in the cavity walls, the least in the seeds; in darkness, however, the highest activity is in the placental tissues. Labeled $CO_2$ carries $C^{14}$ to org. acids, sugars, amino acids, and fats. The radioactivity of these is higher under illumination than in darkness. G. M. K.

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PONTOVICH, V.E.

Activity of oxidizing enzymes and the synthesis of reduced compounds. Trudy Inst. fiziol.rast. 9:242-253 '55.
(MIRA 8:8)

1. Institut fiziologii rastenii im. K.A.Timiryazeva Akademii nauk SSSR.
(Oxidation, Physiological)

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AUTHORS: Pontovich, V.E., Pinchuk, L. M. SOV/ 20-120-3-41/67

TITLE: On the Content of Volatile Acids in the Fruit of Oil-Poppy (O soderzhanii letuchikh kislot v plodakh maka maslichnogo)

PERIODICAL: Doklady Akademii nauk SSSR, 1958, Vol. 120, Nr 3, pp. 585-587 (USSR)

ABSTRACT: The investigation of the physiology of fruits represents one of the ways to examine the process of oil formation in the seeds of higher plants, in particular the study of the accumulation and transformation character of the substances, which are transported from the assimilating organs into the fruits. On the strength of their earlier investigations of poppy fruits (Ref 1,2) the authors pronounced the assumption, that not all compounds which participate in the synthesis of reserve substances are produced in the seeds. The placenta obviously directly participates in the production of the fat predecessors. In order to determine the role played by some fruit elements in the synthesis of the reserve substances, the authors investigated these organs with respect to the influx and the content of compounds, which immediately take

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On the Content of Volatile Acids in the Fruit of Oil-Poppy SOV/ 20-120-3-41/67

part in the fat production (hydrocarbons, volatile acids). The obtained results (Figs 1,2, Table pp. 586) permit to draw the following conclusions:

1) Acetic acid represents the main content of volatile acids in the fruits of oil-poppy. Formic acid appears only at certain periods and in small quantities.
2) The production and the accumulation of acids in individual parts of the fruit (wall, placenta, seeds) and in the leaves modifies in the course of the ontogenesis and exhibits a different character.
3) The maximum velocity of the production and the accumulation of acetic acid in the wall and in particular in the placenta coincides with the period of the intensive oil synthesis in the seeds.
4) The utilization of acetic acid which is produced in the placenta, by the seeds for the purpose of fat synthesis is possible. There are 2 figures, 1 table , and 11 references, 3 of which are Soviet.

Card 2/3

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"APPROVED FOR RELEASE: 07/13/2001 CIA-RDP86-00513R001342210003-5

PONTOVICH, V.E.

Sterile placental culture of the poppy as a method of studying seed formation and the synthesis of food reserves in them. Fiziol.rast. 6 no.3:303-311 My-Je '59. (MIRA 12:8)

1. K.A.Timiryazev Institute of Plant Physiology, the U.S.S.R. Academy of Sciences, Moscow.
(Tissue culture) (Seeds)

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PONTOVICH, V.E.

Acetate and the synthesis of amino acids in oil poppy fruit.
Fiziol. rast. 11 no.5:871-878 S-O '64. (MIRA 17:10)

1. Timiriazev Institute of Plant Physiology, U.S.S.R. Academy of Sciences, Moscow.

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PONTOVICH, V.E.

Metabolism of placenta and synthesis of fats in the poppy seeds. Fiziol. rast. 9 no.1:32-40 '62. (MIRA 15:3)

1. K.O.Timiriazev Institute of Plant Physiology, U.S.S.R. Academy of Sciences, Moscow.
(Poppy) (Plants--Metabolism)

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"APPROVED FOR RELEASE: 07/13/2001 CIA-RDP86-00513R001342210003-5

PONTOVICH, V. E., (USSR)

"Placental Metabolism and Lipid Synthesis in the Poppy Seed."

Report presented at the 5th Int'l. Biochemistry Congress, Moscow, 10-16 Aug 1961.

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"APPROVED FOR RELEASE: 07/13/2001 CIA-RDP86-00513R001342210003-5

PONTOVICH, V.E.

"Respiration and its role in plant immunity" by B.A.Rubin. Reviewed by V.E.Pontovich. Fiziol.rast. 8 no.3:378-379 '61. (MIRA 14:5)
(Plants—Respiration) (Plants—Disease and pest resistance)
(Rubin, B.A.)

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"APPROVED FOR RELEASE: 07/13/2001 CIA-RDP86-00513R001342210003-5

PONTOVICH, V.E.; KARIMOV, Kh.

Dynamics of amino acids in the fruit of the oilseed poppy.
Fiziol. rast.7 no.2:151-159 '60. (MIRA 14:5)

1. Timiriazev Institute of Plant Physiology, U.S.S.R. Academy of Sciences, Moscow.
(Poppy)
(Amino acids)

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"APPROVED FOR RELEASE: 07/13/2001 CIA-RDP86-00513R001342210003-5

PONTOVICH, V.E.

Sterile cultures of the placenta and seeds as a method of studying metabolism in developing fruit. Izv. AN SSSR. Ser. biol. no.2:233-238 Mr-Ap '61. (MIRA 14:3)

1. Timiryazev Institute of Plant Physiology, Academy of Sciences of the U.S.S.R., Moscow.
(PLANTS—METABOLISM) (TISSUE CULTURE)
(BOTANY—EMBRYOLOGY)

APPROVED FOR RELEASE: 07/13/2001 CIA-RDP86-00513R001342210003-5"

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ALEKSEYEVSKIY, Aleksandr Nikolayevich; PONTRYAGIN, G.M., red.

[Nurseries of ornamental plants and shrubs] Pitomniki dekorativnykh derev'ev i kustarnikov. 2. izd., peror. i dop. Moskva, Stroiizdat, 1965. 277 p. (MIRA 18:3)

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PONTRYAGIN, L. S.

Uber Stetige Algebraische Korper. Ann. of Math., 33 (1932), 163-174.

Sur les Groupes Topologiques Compacts et le Cinquieme Probleme de M. Hilbert. C. R. Acad. Sci. 198 (1934), 238 -240.

Sur les Groupes Abeliens Continues. C. R. Acad. Sci., 198 (1934), 328-330.

The Theory of Topological Commutative Groups. Ann. of Math., 35 (1934), 361-388. (Yest' Russkiy Perevod. Sm. (12) ).

to be continued.

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PONTRYAGIN, L. S. con't. (2)

Teoriya Kommutativnykh Topologicheskikh Grupp. Uspekhi Matem. Nauk, 2 (1936), 177-195 (Perevod /4/)
Linear Representations of Compact Topological Groups. Matem. SB., 1 (43), (1936), 267-272.
Nepreryvnyye Gruppy. M. - L., GTTI (1938), 1-315.
Homologies in Compact Lies Groups. Mathem. SB., 6 (48), (1939), 389-422.
Über Topologische Structur der Lieschen Gruppen. Comment. Math. Helv., 13 (1941), 277-283.
O Nulyakh Nekotorykh Elementarnykh Transtsendentnykh Funktsiy. Ian. Ser. Mathem., 6 (1942), 115-134.
Zum Alexanderschen Dualitätssatz. Gött. Nachr. (1927), 315-322.
Sur une Hypothèse Fondamentale de la Thèorie de la Dimension. C. R. Acad. Scl., 190 (1930), 1105-1107.
Der Allgemeine Dualitätssatz für Abgeschlossene Mengen. Int. Mathematikerkongress Zurich, 2, (1932), 195-197.
The General Topological Theorem of Duality for Closed Sets. Ann. of Math., 35 (1934), 904-914. (yest' Russkiy Pere-Vod Sm. / 27/.)
Les Fonctions Presque Périodiques et l'Analisis Situs. C. R. Acad. Sci., 196 (1933), 1201- 1203.
Über den Algebraischen Inhalt Topolo Gischen Dualität-ssätze. Math. Ann., 105 (1931), 165-205.
Kharakteristicheskiye Tsikly. Mnogoobrazik Dan, 35 (1942), 35-39.
Ermitovy Operatory V Prost Ranstve S Indefinitnoy Metrikov. I. An., Ser. Matem., 8 (1944), 243-280.

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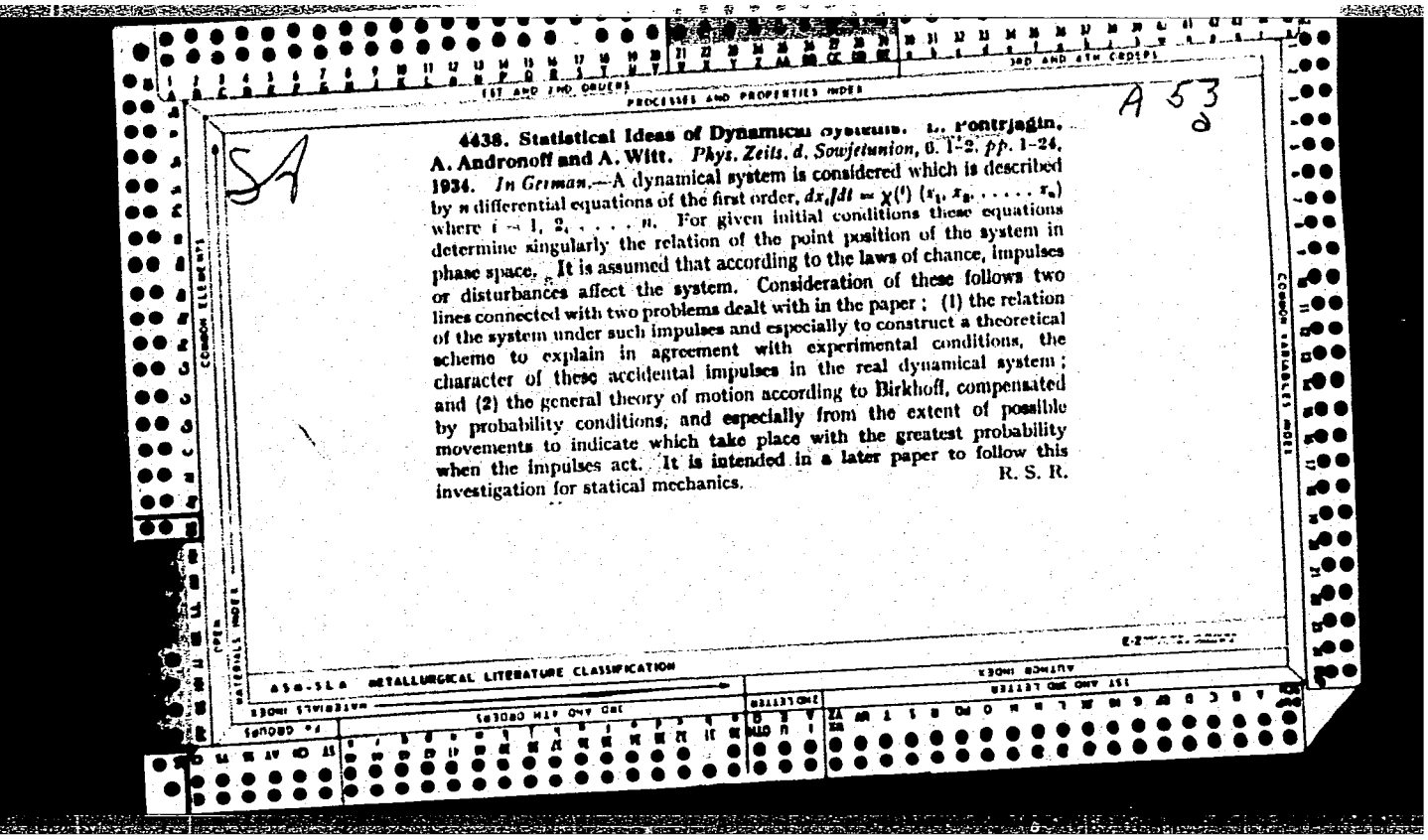

4438. **Statistical Ideas of Dynamical Systems.** L. Pontrjagin, A. Andronoff and A. Witt. *Phys. Zeits. d. Sowjetunion*, 6. 1-2. *pp.* 1-24, 1934. *In German.*—A dynamical system is considered which is described by $n$ differential equations of the first order, $dx_i/dt = \chi^{(i)}(x_1, x_2, \ldots, x_n)$ where $i = 1, 2, \ldots, n$. For given initial conditions these equations determine singularly the relation of the point position of the system in phase space. It is assumed that according to the laws of chance, impulses or disturbances affect the system. Consideration of these follows two lines connected with two problems dealt with in the paper: (1) the relation of the system under such impulses and especially to construct a theoretical scheme to explain in agreement with experimental conditions, the character of these accidental impulses in the real dynamical system; and (2) the general theory of motion according to Birkhoff, compensated by probability conditions; and especially from the extent of possible movements to indicate which take place with the greatest probability when the impulses act. It is intended in a later paper to follow this investigation for statical mechanics.

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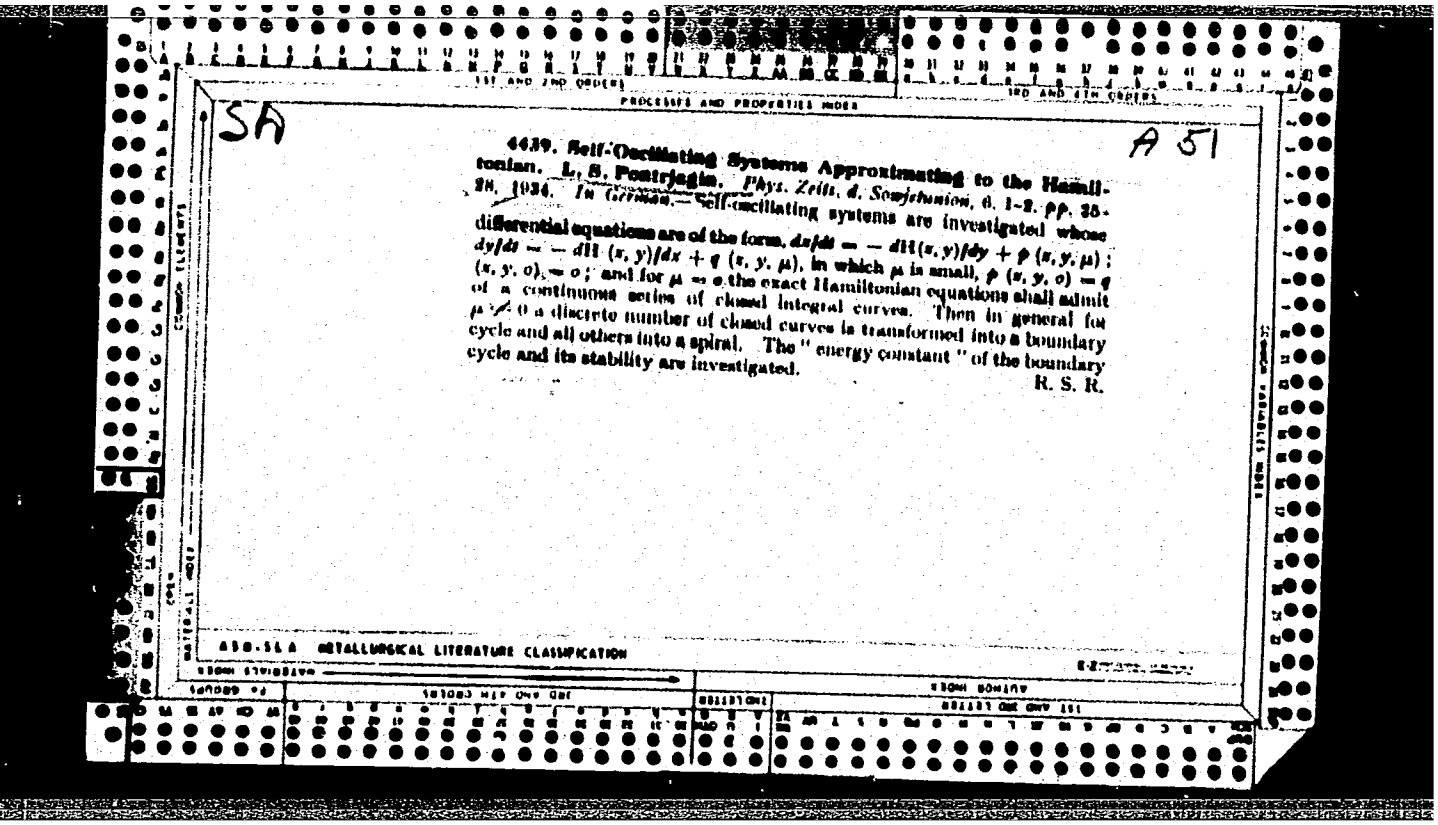

SA

A 51

4439. **Self-Oscillating Systems Approximating to the Hamiltonian.** L. S. Pontryagin. *Phys. Zeits. d. Sowjetunion*, 6. 1-2. pp. 25-28. 1934. *In German.*—Self-oscillating systems are investigated whose differential equations are of the form, $dx/dt = -dH(x,y)/dy + p(x,y,\mu)$; $dy/dt = -dH(x,y)/dx + q(x,y,\mu)$, in which $\mu$ is small, $p(x,y,0) = q(x,y,0) = 0$; and for $\mu = 0$ the exact Hamiltonian equations shall admit of a continuous series of closed integral curves. Then in general for $\mu \neq 0$ a discrete number of closed curves is transformed into a boundary cycle and all others into a spiral. The "energy constant" of the boundary cycle and its stability are investigated.

R. S. R.

A50.5L4 METALLURGICAL LITERATURE CLASSIFICATION

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PONTRYAGIN L.S.

Pontryagin, L. S. Osnovy Kombinatornoĭ Topologii. [Foundations of Combinatorial Topology.] OGIZ, Moscow-Leningrad, 1947. 143 pp.

Complexes and their Betti groups, The invariance of the Betti groups, Continuous mappings and fixed points.

*Table of contents.*

Source: Mathematical Reviews, 1950 Vol 11 No. 6

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"APPROVED FOR RELEASE: 07/13/2001 CIA-RDP86-00513R001342210003-5

Pontryagin, L.

Glezerman, M., and Pontryagin, L. Intersections in manifolds. Uspehi Matem. Nauk (N.S.) 2, no. 1(17), 58–155 (1947). (Russian)

This is a text based on a course of lectures delivered by Pontryagin, compiled under his direction several years ago, and recently somewhat revised. Its primary purpose is a systematic and unexceptionable exposition of the "intersection-ring" of a complex. This is the algebraic ring, designated the Lefschetz ring, based upon the direct sum of the Betti groups of the given complex in which the product of two cycles is taken to be the oriented cycle which is their intersection in the sense due to Lefschetz [Trans. Amer. Math. Soc. 28, 1–49 (1926); there is no reference to the same author's "Algebraic Topology," Amer. Math. Soc. Colloquium Publ., v. 27, New York, 1942; these Rev. 4, 84]. The extensive generalizations of this theory due to Alexander and Kolmogoroff are mentioned, and it is proved in the concluding section of the paper that the Lefschetz ring is isomorphic to the Alexander ring [Ann. of Math. (2) 37, 698–708 (1936)]. This fact is given as proof that the Lefschetz ring is a topological invariant. To demonstrate the isomorphism the authors finally restrict the theory to the class of homology-manifolds and make use of the Poincaré duality expressed in terms of cohomology theory.

The emphasis of the presentation is less upon the generality of the theory than upon what the authors call the "thoroughly pedantic" analysis of its details. They serve notice that the details are numerous and the thorough analysis formidable. These details have to do with three main points. First the notion of "general position," second the orientation of the intersection of chains, third the existence within homology classes of representatives in general position. Forty pages comprising the first two sections are devoted to the notion of "general position" and the orientation of polyhedra contained in a Euclidean space. Section three discusses complexes and a class of chains of the complex called polygonal chains which are in sufficiently general position in the complex (with respect to its cells of highest dimension). The fourth section deals with barycentric subdivisions showing incidentally that the Lefschetz ring is invariant under subdivision. The main purpose of the section is to provide a method of subdivision which will lead to the isomorphism of the Lefschetz and Alexander rings. This isomorphism is established in the fifth and final section.

*L. Zippin* (Flushing, N. Y.)

Source: Mathematical Reviews, Vol 10 No. 6

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"APPROVED FOR RELEASE: 07/13/2001 CIA-RDP86-00513R001342210003-5

Pontryagin, L. S.

Pontryagin, L. S. Topological duality theorems. Uspehi Matem. Nauk (N.S.) 2, no. 2(18), 21–44 (1947). (Russian)

This is a fairly detailed article on the substance of a paper of the author [Math. Ann. 105, 165–205 (1931)]. The older paper is substantially recast, the proofs being "strongly modernized" (in the author's words), to make use of cohomology theory and the theory of character groups. Both of these theories were developed subsequently to the original paper. The reader is expected to be familiar with the material in the first four chapters of Seifert and Threlfall's "Lehrbuch der Topologie" [Teubner, Leipzig-Berlin, 1934] and the first chapter of the author's paper on topological groups [Ann. of Math. (2) 35, 361–388 (1934)]. The needed combinatorial concepts are reviewed in the paper but none pertaining to character group theory are developed, the reader being referred to the paper cited for each needed theorem. *L. Zippin* (Flushing, N. Y.).

Source: Mathematical Reviews, Vol 10, No. 1

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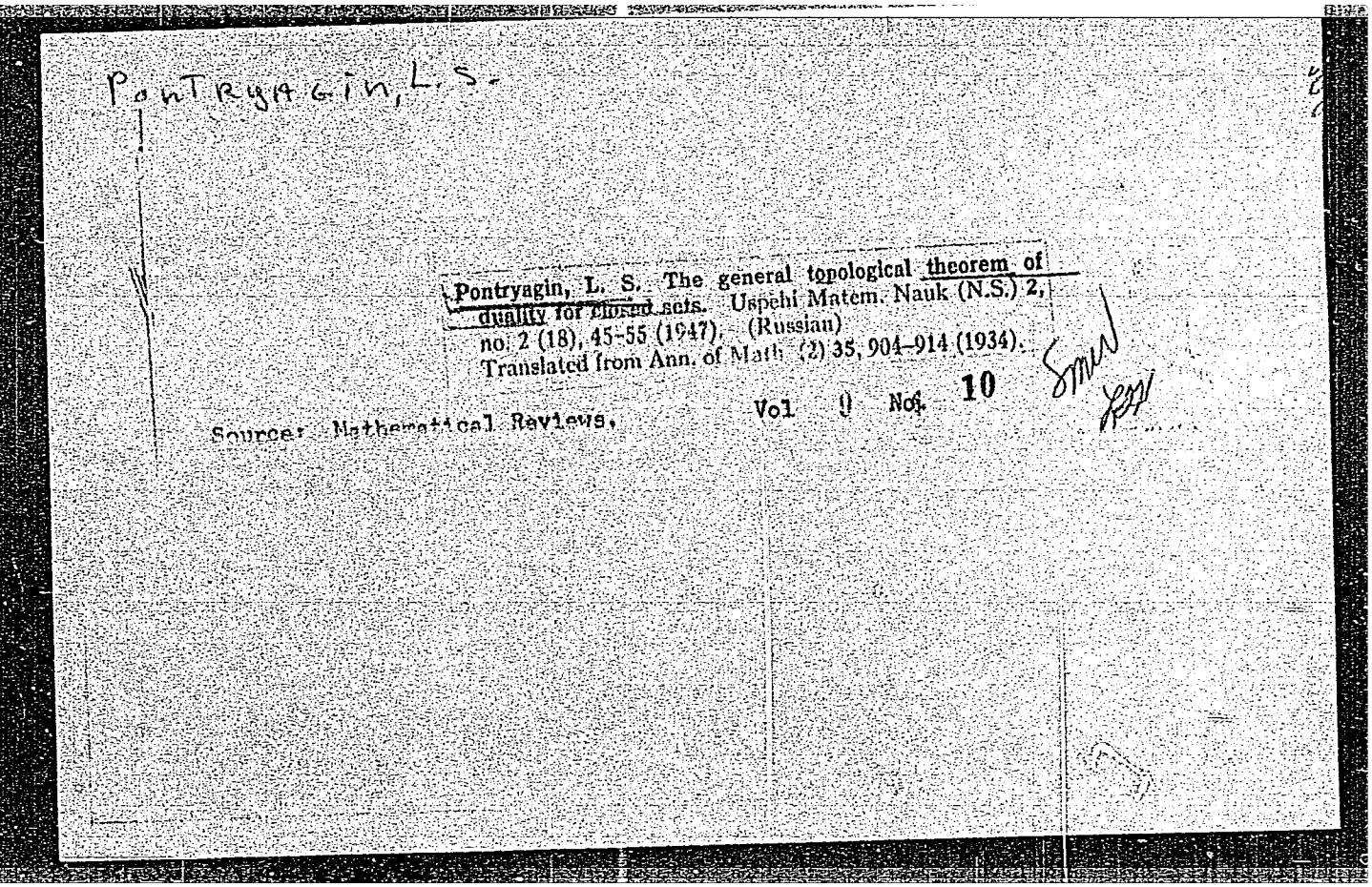

PONTRYAGIN, L. S.

Pontryagin, L. S. The general topological theorem of duality for closed sets. Uspehi Matem. Nauk (N.S.) 2, no. 2 (18), 45–55 (1947). (Russian)
Translated from Ann. of Math. (2) 35, 904–914 (1934).

Source: Mathematical Reviews, Vol 9 No. 10

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"APPROVED FOR RELEASE: 07/13/2001 CIA-RDP86-00513R001342210003-5

PONTRYAGIN, L.S

Pontryagin, L. S. Characteristic cycles on differentiable manifolds. Mat. Sbornik N.S. 21(63), 233–284 (1947). (Russian)

This is a detailed account of results already noted [C. R. (Doklady) Acad. Sci. URSS (N.S.) 35, 34–37 (1942); these Rev. 4, 147; some necessary definitions will be repeated here for the reader's convenience]. The author remarks on the close connection of his work to that of Whitney [see the cited review]. In a paper to be published soon, he promises a closer study of the relation of his more general results to those of Stiefel, as well as an alternative procedure for the actual calculation of the characteristic cycles with which this paper is concerned. He regards as still open the question of the "newness" of invariants of this type.

Let $M^k$ be a differentiable orientable manifold of dimension $k$ and $f(M^k)$ a homeomorphic image, with continuously turning tangent, in a Euclidean $R^{k+l}$. Let $H(k, l)$ be the space of oriented $k$-planes through the origin of $R^{k+l}$; this is of dimension $k \cdot l$. For $x \in M^k$, let $T(x)$ denote the element of $H(k, l)$ which is parallel to the tangent $k$-plane to $f(M^k)$ at $f(x)$. The map $T(x)$ is called the tangential map of the abstract $M^k$ and is independent, to within a homotopy, of the particular imbedding $f(M^k)$. If $Z$ is a cycle of $H(k, l)$ of dimension $kl-r$, $r \leqq k$, there exists a homeomorphism $T_1$ of $M^k$ into $H(k, l)$ which approximates $T$ and for which $Z$ and $T_1(M^k)$ are in general position. Let $X$ denote the inverse image under $T_1$ of the intersection $Z \times T_1(M^k)$. The homology class of the $(k-r)$-dimensional cycle $X$ depends on $Z$ (and, of course, $M^k$) alone. When $Z$ is one of a set of base cycles of $H(k, l)$, the associated $X$ is called a generating characteristic cycle of $M^k$.

The author selects his base cycles following procedures credited to Ehresmann [reference here to Ann. of Math. (2) 35, 396–443 (1934); J. Math. Pures Appl. (9) 16, 69–100 (1937)]. Let $\omega(i)$, $i = 1, \cdots, k$, be an integral-valued non-decreasing function with $0 \leqq \omega(i) \leqq l$. Let $R_1 \subset R_2 \subset \cdots \subset R_k$ be some associated monotonic system of linear spaces in $R^{k+l}$ and let the dimension of $R_i$ be $\omega(i)+i$. Denote by $Z(\omega)$ the set of all $R^k \in H(k, l)$ such that the dimension of the intersection of $R^k$ and $R_i$ is not less than $i$. In general, $Z(\omega)$ is a closed pseudomanifold, and is of dimension $r(\omega) = \sum \omega(i)$. When it is orientable, $Z(\omega)$ may be regarded as a cycle with integral coefficients; when nonorientable, as a cycle mod 2. In the latter case, if $Y$ is a nonorientable cycle, the author associates with it a cycle with integral coefficients, designated by $\mathfrak{T}Y$, whose homology class is determined by $Y$. When $Z(\omega)$ is of dimension zero it is an integer or an "integer mod 2," but still regarded as a characteristic cycle. In all cases, $Z(\omega)$ is determined by the function $\omega$, not the particular associated sequence $R_i$. The author introduces a complementary function $\chi = \chi(i)$, defined by $\omega + \chi = l$; and finds his base cycles among those whose functions satisfy $l-1 \geqq \chi(i) \geqq 0$ and, also, $r(\chi) = \sum \chi(i) \leqq k$. As a change in notation, $Z(\omega) = Z_\chi$ for any $\omega$ and complementary $\chi$.

Certain classes of functions $\chi$ are now investigated. Let $i_1, i_2, \cdots, i_{s-1}$ designate the "jump-spots" for the function:

Source: Mathematical Reviews, 1948, Vol 9, No. 5

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Pontryagin, L.S.

$l \geq 2$, $H(k, l) - Z(\omega)$ is simply connected. In § 2 there is defined a suitable orientation for the orientable $Z(\omega)$; § 3 is devoted to the tangential mapping and characteristic cycles; § 4 is entitled "the cellular subdivision of $H(k, l)$"; § 5 is devoted to the homology basis for $H(k, l)$. The final section is entitled "certain properties of characteristic cycles" and contains the proofs of theorems 2 and 3. *L. Zippin.*

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Mathematical Reviews, 1948, Vol 9, No.5

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PONTRYAGIN, L.S.

Topology in the Soviet Union. Uch. zap. Mosk. un. no.91:65-76 '47. (MIRA 11:7)

(Topology)

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